DERUCKI
CONSTRUCTION COMPANY, LLC

OPERATIONS AND MAINTENANCE MANUAL

WHITE PROVISION – LANDLORD'S WORK – SUITE A06/A07

ATLANTA, GA

Provided To:

White Provision Suite A06/A07

1100 Howell Mill Rd., NW
Atlanta, GA 30318

5100 Old Ellis Point, Suite 200, Roswell, GA, 30076
Phone: 678-947-8505 Fax: 678-947-8582

WHITE PROVISION – LANDLORD'S WORK – SUITE A06/A07

Atlanta, GA

Project Owner:

White Provision Redevelopment, L.P.
3625 Cumberland Blvd
Twelfth Floor
Atlanta, GA 30339

Project Team

Design Team

Architect of Record:

Square Feet Studio
154 Krog St. NE
Suite 170
Atlanta, GA 30307

Building Department:

City of Atlanta
Beaeau of Buildings
55 Trinity Avenue
Suite 3900
Atlanta, GA 30303

Phone: 404-330-6150
Fax: 404-658-6979
Email: bobinformation@atlantaga.gov

Construction Team

Construction Manager:

Derucki Construction Company, LLC
Contact: John Derucki
5100 Old Ellis Point, Roswell, GA 30076
Phone: 678-947-8505 Fax: 678-947-8582

Project Manager:
Laura Rosenthal
laura@deruckiconstruction.com
Mobile: 470-201-0655

Superintendent:
Greg Powell
gregpowell@deruckiconstruction.com
Mobile: (678) 409-2384

DERUCKI
CONSTRUCTION COMPANY, LLC

White Provision – Landlord's Work - Suite A06/A07

Subcontractor Contact Information

TAB #	Sub Name	Scope	City	Contact	Phone
092	R&T General Construction, Inc.	Drywall	Atlanta	Jim Furness Jimfur80@gamil.com	678-618-2750
150	Randal Lowe Plumbing, LLC.	Plumbing	Marietta	Don Burton Gayle@RandalLowe.com	770-423-1660
157	Bardi Heating and Air, Inc.	HVAC	Norcross	Denis Irkhin denisirkhin@bardi.com	770-263-9300
160	Putzel Electrical Contractors	Electric	Atlanta	Bruce Davidson bruce@putzelelectric.com	678-738-0827

5100 Old Ellis Point, Suite 200, Roswell, GA, 30076.
Phone: 678-947-8505 Fax: 678-947-8582

EXHIBIT "D"
SUBCONTRACTOR/VENDOR WARRANTY FORM

PROJECT: WHTIE PROVISION – LANDLORDS WORK SUITE A06/A07

OWNER: WHITE PROVISION REDEVELOPEMENT, L.P.

GENERAL CONTRACTOR: Derucki Construction Company, LLC

We, R & T GENERAL CONSTRUCTION, Subcontractor /Vendor for WHITE PROVISION SUITE A06/A07 described in Specification Section(s) Reference Subcontract Exhibit A Do hereby warrant that all labor and materials furnished and work performed in conjunction with the above referenced project are in accord with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials and workmanship for a period of ONE YEAR from Date of Acceptance. This warranty commences on 12/20/2013 and expires on 12/20/2014.

Should any defect develop during the warranty period due to improper material, workmanship, or arrangement, the same shall, upon written notice by the Owner, be made good by the undersigned at no expense to the Owner. Nothing in the above shall be deemed to apply to work which has been abused or neglected by the Owner.

DATE: 12/20/13

FOR: R&T General Const. Inc

BY: _____

TITLE: VP

Sworn to and subscribed before me this 20th day of Dec, 2013

_____
Notary Public

My Commission Expires: May 2013

EXHIBIT "D"
SUBCONTRACTOR/VENDOR WARRANTY FORM

PROJECT: **WHTIE PROVISION – LANDLORDS WORK SUITE A06/A07**

OWNER: **WHITE PROVISION REDEVELOPEMENT, L.P.**

GENERAL CONTRACTOR: Derucki Construction Company, LLC

We, RANDAL LOWE PLUMBING, Subcontractor /Vendor for WHITE PROVISION SUITE A06/A07 described in Specification Section(s) Reference Subcontract Exhibit A Do hereby warrant that all labor and materials furnished and work performed in conjunction with the above referenced project are in accord with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials and workmanship for a period of **ONE YEAR** from Date of Acceptance. This warranty commences on **12/20/2013** and expires on **12/20/2014.**

Should any defect develop during the warranty period due to improper material, workmanship, or arrangement, the same shall, upon written notice by the Owner, be made good by the undersigned at no expense to the Owner. Nothing in the above shall be deemed to apply to work which has been abused or neglected by the Owner.

DATE: 12-19-13

FOR: Randal Lowe Plumbing, LLC

BY: Wayne Lowe

TITLE: Member

Sworn to and subscribed before me this 19TH day of DEC, 2013

JESSICA FISCHER
NOTARY PUBLIC
PAULDING COUNTY, GEORGIA
MY COMMISSION EXPIRES MAY 28, 2017

Notary Public

My Commission Expires: MAY 28, 2017

EXHIBIT "D"
SUBCONTRACTOR/VENDOR WARRANTY FORM

PROJECT: **WHTIE PROVISION – LANDLORDS WORK SUITE A06/A07**

OWNER: **WHITE PROVISION REDEVELOPEMENT, L.P.**

GENERAL CONTRACTOR: Derucki Construction Company, LLC

We, BARDI HEAT AND AIR INC, Subcontractor /Vendor for WHITE PROVISION SUITE A06/A07 described in Specification Section(s) Reference Subcontract Exhibit A Do hereby warrant that all labor and materials furnished and work performed in conjunction with the above referenced project are in accord with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials and workmanship for a period of **ONE YEAR** from Date of Acceptance. This warranty commences on **12/20/2013** and expires on **12/20/2014.**

Should any defect develop during the warranty period due to improper material, workmanship, or arrangement, the same shall, upon written notice by the Owner, be made good by the undersigned at no expense to the Owner. Nothing in the above shall be deemed to apply to work which has been abused or neglected by the Owner.

DATE: 1/3/14

FOR: Bardi Heating & Air Condition Inc.

BY: [signature]

TITLE: Project Manager

Sworn to and subscribed before me this 3rd day of January, 2014

KAREN A ALLEN NOTARY PUBLIC GWINNETT COUNTY, GEORGIA MY COMMISSION EXPIRES JULY 14, 2017

[signature]
Notary Public

My Commission Expires: July 14, 2017

HVAC

O&Ms for

White Provision

1100 Howell Mill Road NW Suite A06/A07
Atlanta, GA 30318

General Contractor: Derucki Construction Company

Mechanical Contractor: Bardi Mechanical

Project Manager: Tom Foran

Date: 1/3/14

www.bardi.com
2175 Royal Palm Court • Norcross, Georgia 30071 • Residential 770.263.5355 • Commercial 770.263.9300 • Fax 770.263.9400

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Bardi
24/7 Heating & Air Conditioning
The Climate's Always Right With Bardi

Section #1

Heat Pump Condensing Unit

Carrier

Residential Air Conditioners and Heat Pumps Using R- 22 and Puron® Refrigerant

Carrier
turn to the experts

Application Guideline and Service Manual

TABLE OF CONTENTS

UNIT IDENTIFICATION

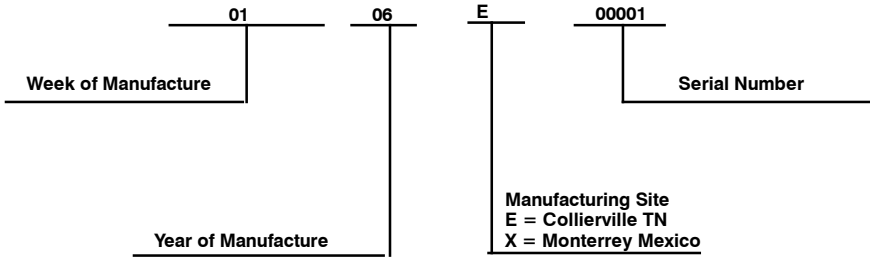
Troubleshooting Charts for Air Conditioners and Heat Pumps are provided in the appendix at back of this manual. They enable the service technician to use a systematic approach to locating the cause of a problem and correcting system malfunctions.

This section explains how to obtain the model and serial number from unit rating plate. These numbers are needed to service and repair the Puron® and R-22 air conditioner or heat pump. Model and serial numbers can be found on unit rating plate.

AIR CONDITIONER AND HEAT PUMP MODEL NUMBER NOMENCLATURE

1 2	3	4	5	6	7 8	9	10	11	12	13	14	15	16
2 4	A	B	A	3	3 6	A	0	0	3	0	0	0	0
Series	Family	Tier	Major Series	SEER	Cooling Capacity (Tons)	Variations	Open	Open	Voltage	Minor Series	Packaging	Parts Identification	Open
24 = AC 25 = HP	A = A/C H = HP	B = Base / Comfort C = Comfort / Performance P = Performance N = Infinity	A,B = Puron R,S = R22	3 = 13 SEER 5 = 15 SEER 6 = 16 SEER 8 = 18 SEER 1 = 21 SEER 7 = 17 SEER	18 = 1- 1/2 24 = 2 30 = 2- 1/2 36 = 3 42 = 3- 1/2 48 = 4 60 = 5	A = Standard C = Coastal F = Full Featured G = Dense Grill L = Louvers	0 = Not Defined	0 = Standard L = Aluminum	1 = 575- 3 3 = 208/230- 1 5 = 208/230- 3 6 = 460- 3 7 = 230- 1- 50 9 = 400- 3- 50	0 = Initial Series	0 = Domestic 1 = Import	0 = Recip. 1 = Scroll 2 = Staged Recip. 3 = Staged Scroll 4 = Other Compr.	0 = Not Defined

SERIAL NUMBER NOMENCLATURE



SAFETY CONSIDERATIONS

Installation, service, and repair of these units should be attempted only by trained service technicians familiar with standard service instruction and training material.

All equipment should be installed in accordance with accepted practices and unit Installation Instructions, and in compliance with all national and local codes. Power should be turned off when servicing or repairing electrical components. Extreme caution should be observed when troubleshooting electrical components with power on. Observe all warning notices posted on equipment and in instructions or manuals.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Puron® (R-410A) systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on Puron® equipment. Ensure service equipment is rated for Puron®.

Refrigeration systems contain refrigerant under pressure. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

INTRODUCTION

This document provides required system information necessary to install, service, repair or maintain the family air conditioners and heat pumps using R22 or Puron refrigerant.

Refer to the unit Product Data for rating information, electrical data, required clearances, additional component part numbers and related pre-sale data. Installation Instructions are also available per specific models.

Information in this document refers to units produced in 2012 and later. Refer to Service Manual number 24-25-3SM for products produced 2006 - 2012.

INSTALLATION GUIDELINE

Residential New Construction

Specifications for these units in the residential new construction market require the outdoor unit, indoor unit, refrigerant tubing sets, metering device, and filter drier listed in Product Data (PD). DO NOT DEVIATE FROM PD. Consult unit Installation Instructions for detailed information.

Add-On Replacement (Retrofit) - R22 to Puron

Specifications for these units in the add-on replacement/retrofit market require change-out of outdoor unit, metering device, and all capillary tube coils. Change-out of indoor coil is recommended. There can be no deviation.

1. If system is being replaced due to compressor electrical failure, assume acid is in system. If system is being replaced for any other reason, use approved acid test kit to determine acid level. If even low levels of acid are detected install factory approved, 100 percent activated alumina suction-line filter drier in addition to the factory supplied liquid-line filter drier. Remove the suction line filter drier as soon as possible, with a maximum of 72 hr.
2. Drain oil from low points or traps in suction-line and evaporator if they were not replaced.
3. Change out indoor coil or verify existing coil is listed in the Product Data Digest.
4. Unless indoor unit is equipped with a Puron® approved metering device, change out metering device to factory supplied or field-accessory device specifically designed for Puron®.
5. Replace outdoor unit with Puron® outdoor unit.
6. Install factory-supplied liquid-line filter drier.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Never install suction-line filter drier in the liquid-line of a Puron® system.

7. If suction-line filter drier was installed for system clean up, operate system for 10 hr. Monitor pressure drop across drier. If pressure drop exceeds 3 psig, replace suction-line and liquid-line filter driers. Be sure to purge system with dry nitrogen and evacuate when replacing filter driers. Continue to monitor pressure drop across suction-line filter drier. After 10 hr of runtime, remove suction-line filter drier and replace liquid-line filter drier. Never leave suction-line filter drier in system longer than 72 hr (actual time).
8. Charge system. (See unit information plate.)

Seacoast

Coastal units are available in selected models and sizes of Air Conditioners and Heat Pumps. These units have protection to help resist the corrosive coastal environment. Features include:

- Armor plate fins and epoxy coated coils
- Complete baked-on paint coverage (both sides of external sheet metal and grilles)
- Paint coated screws

Coastal environments are considered to be within 2 miles of the ocean. Salt water can be carried as far away as 2 miles from the coast by means of sea spray, mist or fog. Line-of-sight distance from the ocean, prevailing wind direction, relative humidity, wet/dry time, and coil temperatures will determine the severity of corrosion potential in the coastal environment.

ACCESSORIES

Table 1—Required Field- Installed Accessories for Air Conditioners

ACCESSORY	REQUIRED FOR LOW- AMBIENT COOLING APPLICATIONS (Below 55°F/12.8°C)	REQUIRED FOR LONG LINE APPLICATIONS*	REQUIRED FOR SEA COAST APPLICATIONS (Within 2 miles/3.22 km)
Ball Bearing Fan Motor	Yes †‡	No	No
Compressor Start Assist Capacitor and Relay	Yes**	Yes	No
Crankcase Heater	Yes ‡	Yes ‡	No
Evaporator Freeze Thermostat	Yes ‡	No	No
Hard Shut- Off TXV	Yes	Yes	Yes
Liquid Line Solenoid Valve	No	No	No
Motor Master® or Low- ambient Pressure Switch	Yes ‡	No	No
Support Feet	Recommended	No	Recommended
Winter Start Control	Yes ‡	No	No

* For tubing line sets between 80 and 200 ft. (24.38 and 60.96 m) and/or 35 ft. (10.7 m) vertical differential, refer to Residential Piping and Longline Guideline.
† Additional requirement for Low- Ambient Controller (full modulation feature) MotorMaster® Control.
‡ Infinity 2- stage units come standard with this accessory.
** Not required on 2- stage

Table 2—Required Field- Installed Accessories for Heat Pumps

ACCESSORY	REQUIRED FOR LOW- AMBIENT COOLING APPLICATIONS (Below 55°F / 12.8°C)	REQUIRED FOR LONG LINE APPLICATIONS*	REQUIRED FOR SEA COAST APPLICATIONS (Within 2 miles / 3.22 km)
Accumulator	Standard	Standard	Standard
Ball Bearing Fan Motor	Yes †‡	No	No
Compressor Start Assist Capacitor and Relay	Yes **	Yes	No
Crankcase Heater	Yes ‡	Yes ‡	No
Evaporator Freeze Thermostat	Yes ‡	No	No
Hard Shutoff TXV	Yes	Yes	Yes
Isolation Relay	Yes	No	No
Liquid Line Solenoid Valve	No	See Long- Line Application Guideline	No
Motor Master® Control or Low Ambient Switch	Yes ‡	No	No
Support Feet	Recommended	No	Recommended

* For tubing line sets between 80 and 200 ft. (24.38 and 60.96 m) and/or 20 ft. (6.09 m) vertical differential, refer to Residential Piping and Longline Guideline.
† Additional requirement for Low- Ambient Controller (full modulation feature) MotorMaster® Control.
‡ Infinity 2- stage units come standard with this accessory.
** Not required on 2- stage

ACCESSORY DESCRIPTIONS

Refer to Table 1 for an Accessory Usage Guide for Air Conditioners and Table 2 for Heat Pumps. Refer to the appropriate section below for a description of each accessory and its use.

1. Crankcase Heater

An electric resistance heater which mounts to the base of the compressor to keep the lubricant warm during off cycles. Improves compressor lubrication on restart and minimizes the chance of liquid slugging.

Usage Guideline:

Required in low ambient cooling applications.

Required in long line applications.

Suggested in all commercial applications.

2. Evaporator Freeze Thermostat

An SPST temperature-actuated switch that stops unit operation when evaporator reaches freeze-up conditions.

Usage Guideline:

Required when low ambient kit has been added.

3. Isolation Relay

An SPDT relay which switches the low-ambient controller out of the outdoor fan motor circuit when the heat pump switches to heating mode.

Usage Guideline:

Required in all heat pumps where low ambient kit has been added

4. Low-Ambient Pressure Switch

A fan-speed control device activated by a temperature sensor, designed to control condenser fan motor speed in response to the saturated, condensing temperature during operation in cooling mode only. For outdoor temperatures down to -20°F (-28.9°C), it maintains condensing temperature at 100°F ± 10°F (37.8°C ± 12°C).

Usage Guideline:

A Low Ambient Controller must be used when cooling operation is used at outdoor temperatures below 55°F (12.8°C).

Suggested for all commercial applications.

5. Outdoor Air Temperature Sensor

Designed for use with Carrier Thermostats listed in this publication. This device enables the thermostat to display the outdoor temperature. This device is required to enable special thermostat features such as auxiliary heat lock out.

Usage Guideline:

Suggested for all Carrier thermostats listed in this publication.

6. Thermostatic Expansion Valve (TXV)

A modulating flow-control valve which meters refrigerant liquid flow rate into the evaporator in response to the superheat of the refrigerant gas leaving the evaporator.

Kit includes valve, adapter tubes, and external equalizer tube. Hard shut off types are available.

Usage Guideline:

Accessory required to meet AHRI rating and system reliability, where indoor not equipped.

Hard shut off TXV or LLS required in heat pump long line applications.

Required for use on all zoning systems.

7. Time-Delay Relay

An SPST delay relay which briefly continues operation of indoor blower motor to provide additional cooling after the compressor cycles off.

NOTE: Most indoor unit controls include this feature. For those that do not, use the guideline below.

Usage Guideline:

Accessory required to meet AHRI rating, where indoor not equipped.

8. Wind Baffle

Use only in installations where high winds are prevalent to prevent cross currents from causing abnormal control operation. For construction, refer to Fig. 1.

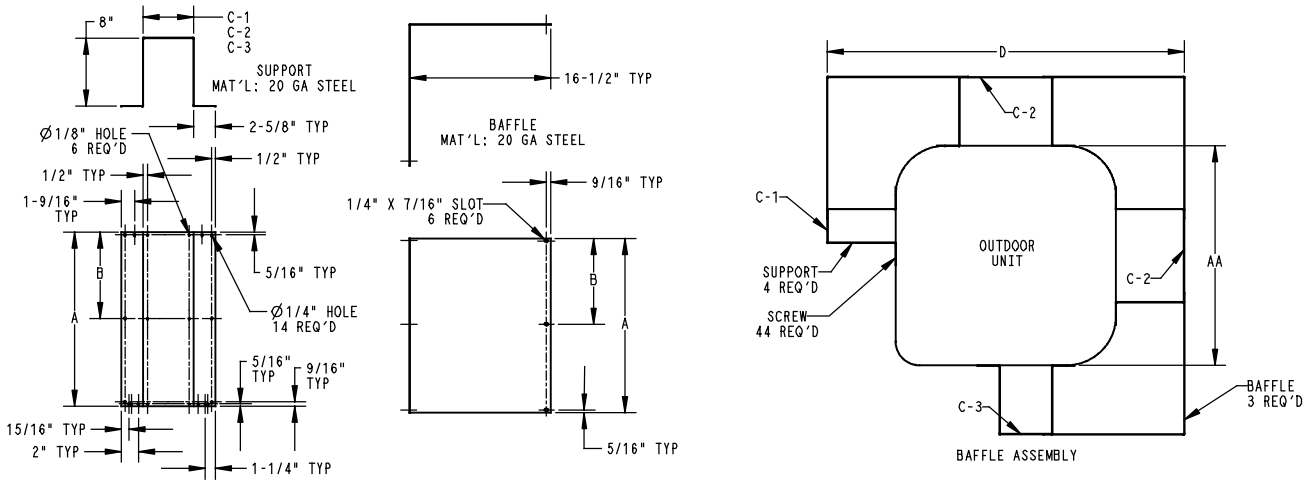
NOTE: When wind baffles are used, raising unit off of mounting pad with 4-in. support feet or unit risers is REQUIRED. This provides better airflow for moderate and high ambient temperatures.

9. Winter Start Control

This control is designed to alleviate nuisance opening of the low-pressure switch by bypassing it for the first 3 minutes of operation. This control is for AC units operating in low ambient cooling but is not required for Heat Pumps. Heat pumps have a loss of charge switch rather than a low pressure switch and nuisance trips should not be an issue.

LOW- AMBIENT COOLING GUIDELINE

The minimum operating temperature for these units in cooling mode is 55°F/12.7°C outdoor ambient without additional accessories. This equipment may be operated in cooling mode at ambient temperatures below 55°F/12.7°C when the accessories listed in Table 1 or 2 are installed. Wind baffles are required when operating in cooling mode at ambients below 55°F/12.7°C. Refer to Fig. 1 for wind baffle construction details for Base through Comfort Series models and Fig. NO TAG for Deluxe models. First production of Performance units are capable of low ambient cooling only with pressure switch or Infinity UI control. Motor Master was not available. See most current Product Data for updates. Infinity Series 2- Stage units are capable of low ambient cooling only with Infinity UI control.



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Entry, Mid Tier, and 4 Sided Deluxe Units (in.)								
UNIT SIZE	**AA**	**UNIT HEIGHT**	**A**	**B**	**C- 1**	**C- 2**	**C- 3**	**D**
Mini Base	23- 1/8	25- 5/16	20- 3/8	10- 1/16	1- 5/16	8- 1/4	3- 1/2	39- 1/4
		28- 11/16	23- 13/16	11- 3/4				
		32- 1/8	27- 3/16	13- 1/2				
		35- 1/2	30- 5/8	15- 3/16				
		38- 15/16	34	16- 7/8				
		42- 5/16	37- 3/8	18- 9/16				
		45- 11/16	40- 13/16	20- 1/4				
Small	25- 3/4	25	20- 3/8	10- 1/16	3- 15/16	10- 7/8	6- 1/8	41- 7/8
		28- 7/16	23- 13/16	11- 3/4				
		31- 13/16	27- 3/16	13- 1/2				
		35- 1/4	30- 5/8	15- 3/16				
		38- 5/8	34	16- 7/8				
		42	37- 3/8	18- 9/16				
		45- 7/16	40- 13/16	20- 1/4				
Medium	31- 1/4	25- 1/2	20- 3/8	10- 1/16	9- 3/8	16- 5/16	11- 9/16	47- 3/8
		28- 15/16	23- 13/16	11- 3/4				
		32- 5/16	27- 3/16	13- 1/2				
		35- 3/4	30- 5/8	15- 3/16				
		39- 1/8	34	16- 7/8				
		42- 1/2	37- 3/8	18- 9/16				
		45- 15/16	40- 13/16	20- 1/4				
Large	35	25- 1/2	20- 3/8	10- 1/16	13- 3/16	20- 1/8	15- 3/8	51- 1/8
		28- 15/16	23- 13/16	11- 3/4				
		32- 5/16	27- 3/16	13- 1/2				
		35- 3/4	30- 5/8	15- 3/16				
		39- 1/8	34	16- 7/8				
		42- 1/2	37- 3/8	18- 9/16				
		45- 15/16	40- 13/16	20- 1/4				

Fig. 1 – Base / Mid- Tier / Deluxe (4- sided) Baffle Assembly

LONG LINE GUIDELINE

Refer to Residential Piping and Long Line Guideline for air conditioner and heat pump systems using Puron refrigerant or Long Line Guideline for R-22 Air Conditioners and Heat Pumps.

CABINET ASSEMBLY

Basic Cabinet Designs

Certain maintenance routines and repairs require removal of the cabinet panels. There are 3 basic cabinet designs for air conditioning and heat pumps. Each design tier has options of standard or dense grills. (See Fig. 2).

Infinity

Performance

Comfort- Puron with Wrap Grille

Entry - R22 with Wrap Grille

Fig. 2 – Cabinet Designs

Access Compressor Or Other Internal Cabinet Components

NOTE: It is not necessary to remove the top cover to gain access. Removing the top cover may cause grill panels, corner posts, louvers or coils to be damaged. It is recommended to protect the top cover from damage of tools, belt buckles, etc. while servicing from the top.

1. Should the unit height allow components to be accessed from the top of the unit, follow procedures for removing fan motor assembly. Access components through the top cap.
2. Large components may not be removed easily without having access from the top and side. Side access may allow procedures such as brazing, cutting, and removal easier. Follow procedures below:

a. Follow procedures to remove the fan motor assembly.

b. Air conditioning units only, remove the screws from the top of the electrical control panel. (Heat pumps will not have screws holding the electrical control panel in place at the top once the control box cover has been removed.)

c. Remove the base pan screws holding the control panel and lift off the unit.

Certain maintenance routines and repairs require removal of cabinet panels.

Remove Top Cover - Mid-Tier / Deluxe

1. Turn off all power to outdoor and indoor units.
2. Remove access panel.
3. Remove information plate.
4. Disconnect fan motor wires and cut wire ties. Remove wires from control box. Refer to unit wiring label.
5. Remove screws holding top cover to louver panels.
6. Lift top cover from unit.
7. Reverse sequence for reassembly.

4-sided deluxe units employ one louver spacer on each of the four sides to prevent louver movement during operation. The louver spacers are trapped between the coil surface and louver at the approximate center of each side (See Fig. 3). This louver spacer should be present and, if dislodged during shipment, must be reinstalled before unit is placed into operation.

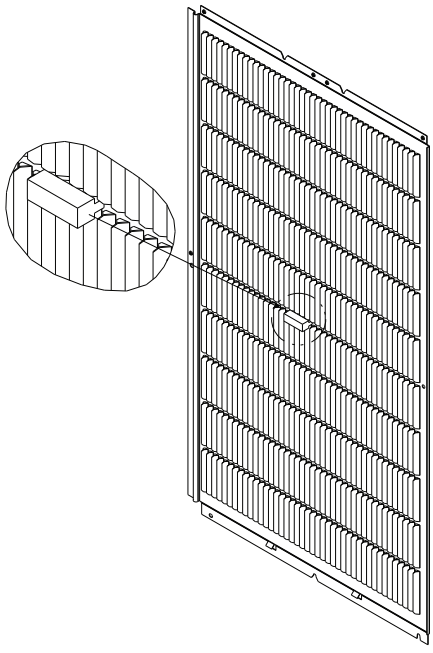

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Fig. 3 – Louver Spacer Location

Remove Fan Motor Assembly - Mid-Tier / Deluxe

1. Perform items 1 through 6 from above.
2. Remove nuts securing fan motor to top cover.
3. Remove motor and fan blade assembly.
4. Reverse sequence for reassembly.
5. Prior to applying power, check that fan rotates freely.

Control Box Cover—Base Products

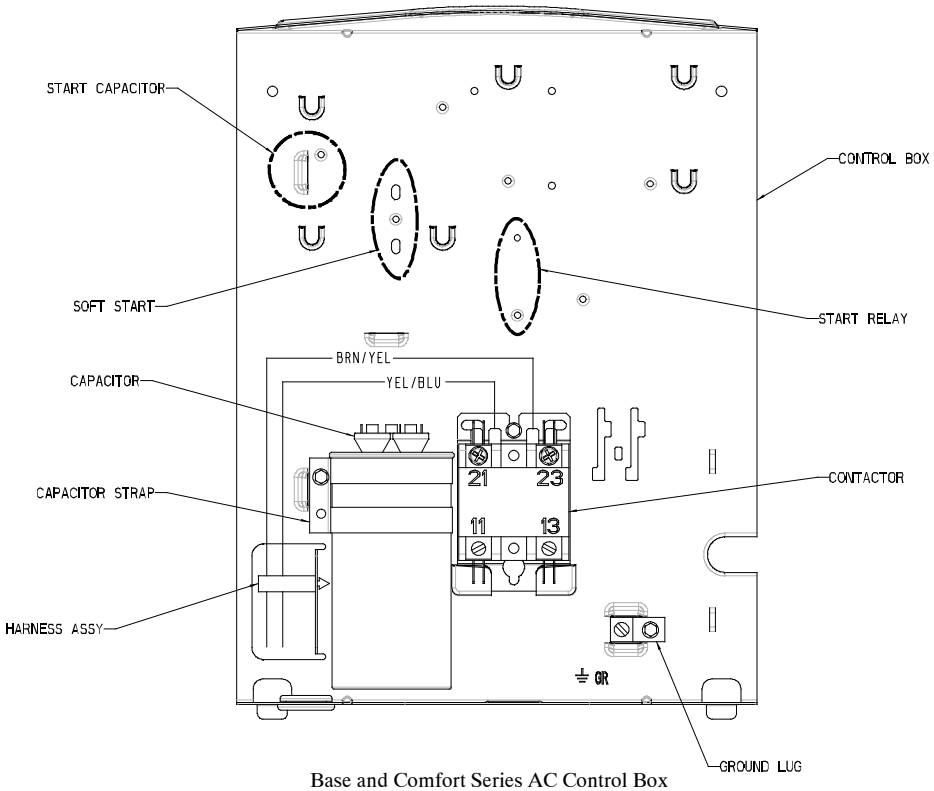
This panel contains much of the same information as the information plate mentioned previously, but is designed only to cover the control box.

Remove Top Cover—Base Products

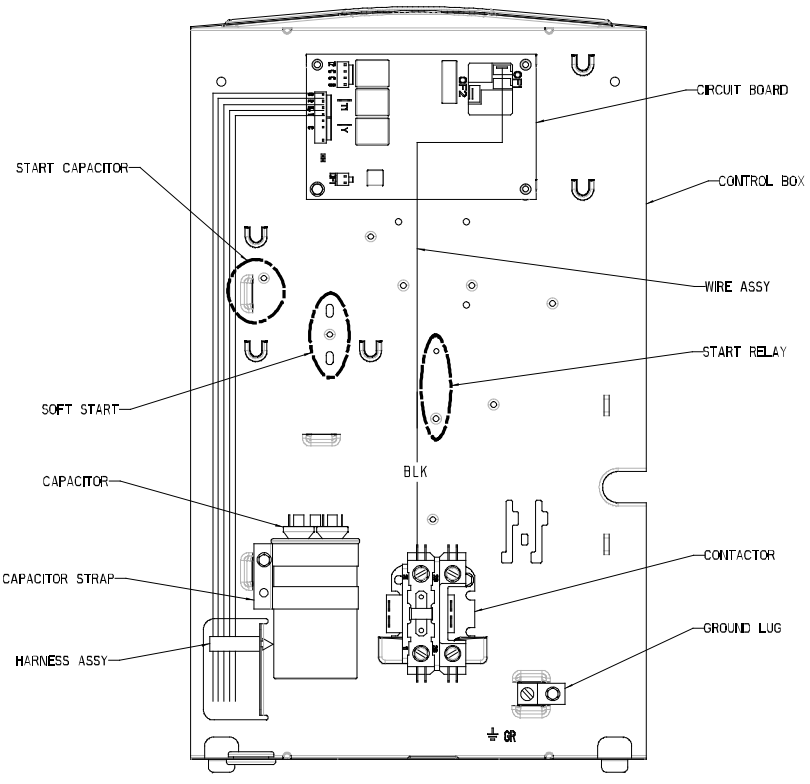
1. Turn off all power to outdoor an indoor units.
2. Remove 5 screws holding top cover to coil grille and coil tube sheet.
3. Remove 2 screws holding control box cover.
4. Remove 2 screws holding information plate.
5. Disconnect fan motor wires, cut any wire ties, and move wires out of control box and through tube clamp on back of control box.
6. Lift top cover from unit.
7. Reverse sequence for reassembly.

Remove Fan Motor Assembly—Base Products

1. Perform items 1, 3, 4, and 5 above. (**Note**: item 2 is not required.)
2. Remove 4 screws holding wire basket to top cover.
3. Lift wire basket from unit.
4. Remove nuts holding fan motor to wire basket.
5. Remove motor and fan blade assembly.
6. Pull wires through wire raceway to change motor.
7. Reverse sequence for reassembly.
8. Prior to applying power, check that fan rotates freely.



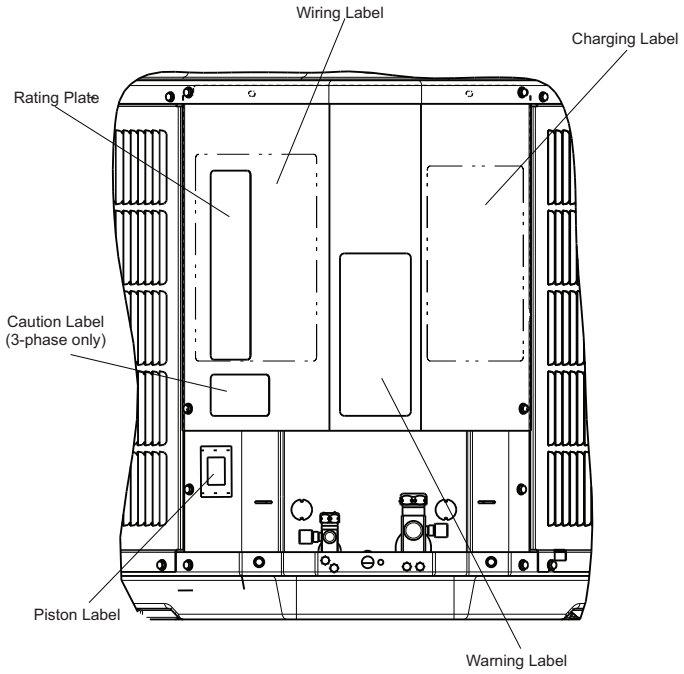
Base and Comfort Series AC Control Box



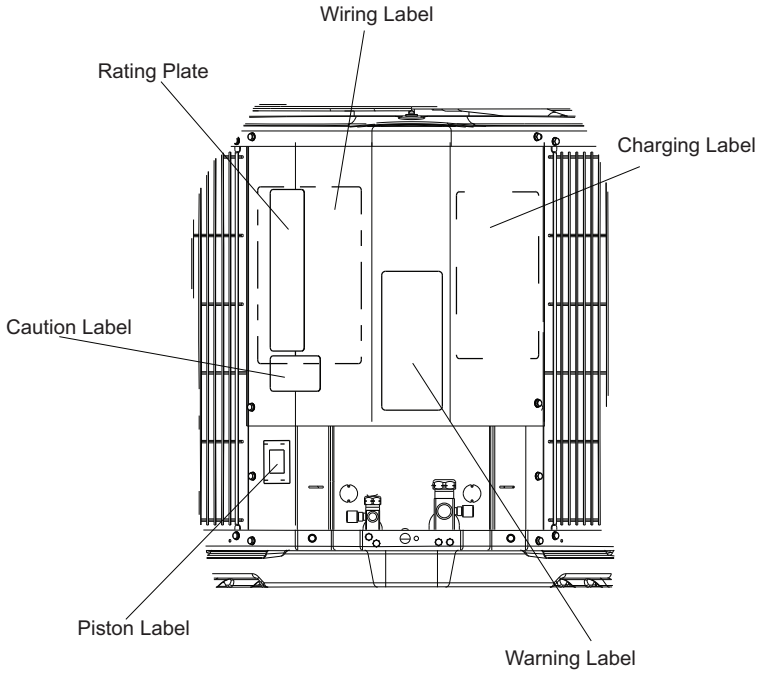
Base and Comfort HP Control Box

Fig. 4 – Base and Comfort Series Control Box Identification

Labeling



Mid- Tier / Deluxe



Entry

Fig. 5 – Label Locations

ELECTRICAL

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Exercise extreme caution when working on any electrical components. Shut off all power to system prior to troubleshooting. Some troubleshooting techniques require power to remain on. In these instances, exercise extreme caution to avoid danger of electrical shock. ONLY TRAINED SERVICE PERSONNEL SHOULD PERFORM ELECTRICAL TROUBLESHOOTING.

Aluminum Wire

⚠ CAUTION

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Aluminum wire may be used in the branch circuit (such as the circuit between the main and unit disconnect), but only copper wire may be used between the unit disconnect and the unit.

Whenever aluminum wire is used in branch circuit wiring with this unit, adhere to the following recommendations.

Connections must be made in accordance with the National Electrical Code (NEC), using connectors approved for aluminum wire. The connectors must be UL approved (marked Al/Cu with the UL symbol) for the application and wire size. The wire size selected must have a current capacity not less than that of the copper wire specified, and must not create a voltage drop between service panel and unit in excess of 2 of unit rated voltage. To prepare wire before installing connector, all aluminum wire must be "brush-scratched" and coated with a corrosion inhibitor such as Pentrox A. When it is suspected that connection will be exposed to moisture, it is very important to cover entire connection completely to prevent an electrochemical action that will cause connection to fail very quickly. Do not reduce effective size of wire, such as cutting off strands so that wire will fit a connector. Proper size connectors should be used. Check all factory and field electrical connections for tightness. This should also be done after unit has reached operating temperatures, especially if aluminum conductors are used.

Contactor

The contactor provides a means of applying power to unit using low voltage (24v) from transformer in order to power contactor coil. Depending on unit model, you may encounter single- or double-pole contactors. Exercise extreme caution when troubleshooting as 1 side of line may be electrically energized. The contactor coil is powered by 24vac. If contactor does not operate:

1. With power off, check whether contacts are free to move. Check for severe burning or arcing on contact points.
2. With power off, use ohmmeter to check for continuity of coil. Disconnect leads before checking. A low resistance reading is normal. Do not look for a specific value, as different part numbers will have different resistance values.
3. Reconnect leads and apply low-voltage power to contactor coil. This may be done by leaving high-voltage power to outdoor unit off and turning thermostat to cooling. Check voltage at coil with voltmeter. Reading should be between 20v and 30v. Contactor should pull in if voltage is correct and coil is good. If contactor does not pull in, replace contactor.
4. With high-voltage power off and contacts pulled in, check for continuity across contacts with ohmmeter. A very low or 0 resistance should be read. Higher readings could indicate burned or pitted contacts which may cause future failures.

Capacitor

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Capacitors can store electrical energy when power is off. Electrical shock can result if you touch the capacitor terminals and discharge the stored energy. Exercise extreme caution when working near capacitors. With power off, discharge stored energy by shorting across the capacitor terminals with a 15,000-ohm, 2-watt resistor.

NOTE: If bleed resistor is wired across start capacitor, it must be disconnected to avoid erroneous readings when ohmmeter is applied across capacitor. (S)

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Always check capacitors with power off. Attempting to troubleshoot a capacitor with power on can be dangerous. Defective capacitors may explode when power is applied. Insulating fluid inside is combustible and may ignite, causing burns.

Capacitors are used as a phase-shifting device to aid in starting certain single-phase motors. Check capacitors as follows:

1. With power off, discharge capacitors as outlined above. Disconnect capacitor from circuit. Put ohmmeter on R X 10k scale. Using an analog ohmmeter, check each terminal to ground (use capacitor case). Discard any capacitor which measures 1/2 scale deflection or less. Place ohmmeter leads across capacitor and place on R X 10k scale. Meter should jump to a low resistance value and slowly climb to higher value. Failure of meter to do this indicates an open capacitor. If resistance stays at 0 or a low value, capacitor is internally shorted.
2. Capacitance testers are available which will read value of capacitor. If value is not within ±10 percent value stated on capacitor, it should be replaced. If capacitor is not open or shorted, the capacitance value is calculated by measuring voltage across capacitor and current it draws.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Exercise extreme caution when taking readings while power is on.

Use following formula to calculate capacitance:

Capacitance (mfd)= (2650 X amps)/volts

3. Remove any capacitor that shows signs of bulging, dents, or leaking. Do not apply power to a defective capacitor as it may explode.

Sometimes under adverse conditions, a standard run capacitor in a system is inadequate to start compressor. In these instances, a start assist device is used to provide an extra starting boost to compressor motor. This device is called a positive temperature coefficient (PTC) or start thermistor. It is a resistor wired in parallel with the run capacitor. As current flows through the PTC at start-up, it heats up. As PTC heats up, its resistance increases greatly until it effectively lowers the current through itself to an extremely low value. This, in effect, removes the PTC from the circuit.

After system shutdown, resistor cools and resistance value returns to normal until next time system starts. Thermistor device is adequate for most conditions, however, in systems where off cycle is short, device cannot fully cool and becomes less effective as a start device. It is an easy device to troubleshoot. Shut off all power to system.

Check thermistor with ohmmeter as described below. Shut off all power to unit. Remove PTC from unit. Wait at least 10 minutes for PTC to cool to ambient temperature.

Measure resistance of PTC with ohmmeter.

The cold resistance (RT) of any PTC device should be approximately 100-180 percent of device ohm rating.

12.5-ohm PTC = 12.5-22.5 ohm resistance (beige color)

If PTC resistance is appreciably less than rating or more than 200 percent higher than rating, device is defective.

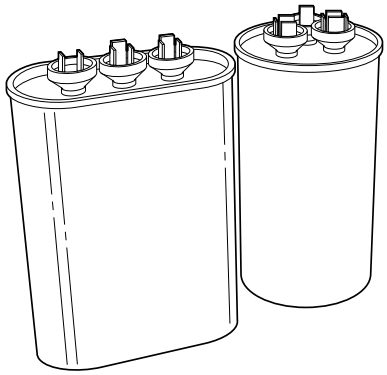


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Fig. 6 – Capacitors

Cycle Protector

Carrier thermostats have anti-cycle protection built in to protect the compressor. Should a non-Carrier stat be utilized, it is recommended to add a cycle protector to the system. Solid-state cycle protector protects unit compressor by preventing short cycling. After a system shutdown, cycle protector provides for a 5 ± 2-minute delay before compressor restarts. On normal start-up, a 5-minute delay occurs before thermostat closes. After thermostat closes, cycle protector device provides a 3-sec delay.

Cycle protector is simple to troubleshoot. Only a voltmeter capable of reading 24v is needed. Device is in control circuit, therefore, troubleshooting is safe with control power (24v) on and high-voltage power off.

With high-voltage power off, attach voltmeter leads across T1 and T3, and set thermostat so that Y terminal is energized. Make sure all protective devices in series with Y terminal are closed. Voltmeter should read 24v across T1 and T3. With 24v still applied, move voltmeter leads to T2 and T3. After 5 ± 2 minutes, voltmeter should read 24v, indicating control is functioning normally. If no time delay is encountered or device never times out, change control.

Crankcase Heater

Crankcase heater is a device for keeping compressor oil warm. By keeping oil warm, refrigerant does not migrate to and condense in compressor shell when the compressor is off. This prevents flooded starts which can damage compressor.

On units that have a single-pole contactor, the crankcase heater is wired in parallel with contactor contacts and in series with compressor. (See Fig. 7.) When contacts open, a circuit is completed from line side of contactor, through crankcase heater, through run windings of compressor, and to other side of line. When contacts are closed, there is no circuit through crankcase heater because both leads are connected to same side of line. This allows heater to operate when system is not calling for cooling. The heater does not operate when system is calling for cooling.

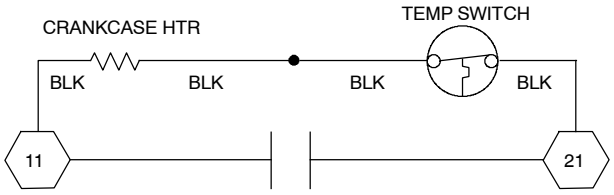

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Fig. 7 – Wiring for Single-Pole Contactor

The crankcase heater is powered by high-voltage power of unit. Use extreme caution troubleshooting this device with power on. The easiest method of troubleshooting is to apply voltmeter across crankcase heater leads to see if heater has power. Do not touch heater. Carefully feel area around crankcase heater. If warm, crankcase heater is probably functioning. Do not rely on this method as absolute evidence heater is functioning. If compressor has been running, the area will still be warm.

With power off and heater leads disconnected, check across leads with ohmmeter. Do not look for a specific resistance reading. Check for resistance or an open circuit. Change heater if an open circuit is detected.

Time-Delay Relay

The TDR is a solid-state control, recycle delay timer which keeps indoor blower operating for 90 sec after thermostat is satisfied. This delay enables blower to remove residual cooling in coil after compression shutdown, thereby improving efficiency of system. The sequence of operation is that on closure of wall thermostat and at end of a fixed on delay of 1 sec, fan relay is energized. When thermostat is satisfied, an off delay is initiated. When fixed delay of 90 ± 20 sec is completed, fan relay is de-energized and fan motor stops. If wall thermostat closes during this delay, TDR is reset and fan relay remains energized. TDR is a 24v device that operates within a range of 15v to 30v and draws about 0.5 amps. If the blower runs continuously instead of cycling off when the fan switch is set to AUTO, the TDR is probably defective and must be replaced.

Pressure Switches

Pressure switches are protective devices wired into control circuit (low voltage). They shut off compressor if abnormally high or low pressures are present in the refrigeration circuit. Puron pressure switches are specifically designed to operate with Puron® systems. R-22 pressure switches must **not** be used as replacements for the Puron® air conditioner or heat pump. Puron® pressure switches are identified by a pink stripe down each wire.

Low-Pressure Switch (AC Only)

The low-pressure switch is located on suction line and protects against low suction pressures caused by such events as loss of charge, low airflow across indoor coil, dirty filters, etc. It opens on a pressure drop at about 50 psig for Puron and about 27 for R22. If system pressure is above this, switch should be closed. To check switch:

1. Turn off all power to unit.
2. Disconnect leads on switch.
3. Apply ohmmeter leads across switch. You should have continuity on a good switch.

NOTE: Because these switches are attached to refrigeration system under pressure, it is not advisable to remove this device for troubleshooting unless you are reasonably certain that a problem exists. If switch must be removed, remove and recover all system charge so that pressure gauges read 0 psi. Never open system without breaking vacuum with dry nitrogen.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant.

To replace switch:

1. Apply heat with torch to solder joint and remove switch.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses when using torch. Have quenching cloth available. Oil vapor in line may ignite when switch is removed.

2. Braze in 1/4-in. flare fitting and screw on replacement pressure switch.

High-Pressure Switch (AC & HP)

The high-pressure switch is located in liquid line and protects against excessive condenser coil pressure. It opens around 610 or 670 psig for Puron and 400 psig for R22 (+/- 10 for both). Switches close at 298 (+/- 20) psig for R-22 and 420 or 470 (+/- 25) psig for Puron. High pressure may be caused by a dirty condenser coil, failed fan motor, or condenser air re-circulation.

To check switch:

1. Turn off all power to unit.
2. Disconnect leads on switch.
3. Apply ohmmeter leads across switch. You should have continuity on a good switch.

NOTE: Because these switches are attached to refrigeration system under pressure, it is not advisable to remove this device for troubleshooting unless you are reasonably certain that a problem exists. If switch must be removed, remove and recover all system charge so that pressure gauges read 0 psi. Never open system without breaking vacuum with dry nitrogen.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant.

To replace switch:

1. Apply heat with torch to solder joint and remove switch.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses when using torch. Have quenching cloth available. Oil vapor in line may ignite when switch is removed.

2. Braze in 1/4-in. flare fitting and replace pressure switch.

Loss of Charge Switch (HP Only)

Located on liquid line of heat pump only, the liquid line pressure switch functions similar to conventional low-pressure switch.

Because heat pumps experience very low suction pressures during normal system operation, a conventional low-pressure switch cannot be installed on suction line. This switch is installed in liquid line instead and acts as loss-of-charge protector. The liquid-line is the low side of the system in heating mode. It operates identically to low-pressure switch except it opens at 23 (+/- 5) psig for Puron and 7 (+/- 5) psig for R22 and closes at 55 (+/- 5) psig for Puron and 22 (+/- 5) for R22 Two-stage heat pumps have the low-pressure switch located on the suction line. The two-stage control board has the capability to ignore low-pressure switch trips during transitional (defrost) operation to avoid nuisance trips. Troubleshooting and removing this switch is identical to procedures used on other switches. Observe same safety precautions.

Defrost Thermostat

Defrost thermostat signals heat pump that conditions are right for defrost or that conditions have changed to terminate defrost. It is a thermally actuated switch clamped to outdoor coil to sense its temperature. Normal temperature range is closed at 30° ± 3°F and open at 65° ± 5°F. Defrost thermostats are used in Base and Comfort models, a coil temperature thermistor is used in Preferred and Infinity series units.

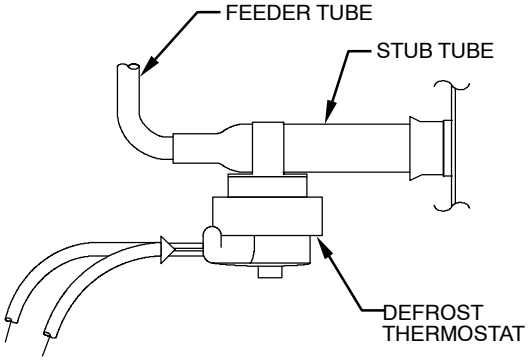

Fig. 8 – Defrost Thermostat Location

Check Defrost Thermostat

There is a liquid header with a distributor and feeder tube going into outdoor coil. At the end of 1 of the feeder tubes, there is a 3/8-in. OD stub tube approximately 2 in. (50.8 mm) long. (See Fig. 8.) The defrost thermostat should be located on stub tube. Note that there is only 1 stub tube used with a liquid header, and on most units it is the bottom circuit.

NOTE: The defrost thermostat must be located on the liquid side of the outdoor coil on the bottom circuit and as close to the coil as possible. For a copper stub tube, the DFT will have a copper cup. For an aluminum stub tube, the DFT will have an aluminum cup. Don't interchange material types.

Defrost Control Board

Troubleshooting defrost control involves a series of simple steps that indicate whether or not board is defective.

NOTE: This procedure allows the service technician to check control board and defrost thermostat for defects. First, troubleshoot to make sure unit operates properly in heating and cooling modes. This ensures operational problems are not attributed to the defrost control board.

HK32EA001/007 DEFROST CONTROL

The HK32EA001/007 defrost control is used in all Comfort Series heat pump models. Its features include selectable defrost intervals of 30, 60, 90 minutes, and standard defrost speed up capability. This section describes the sequence of operation and trouble shooting methods for this control.

Cooling Sequence of Operation (HK32EA001/007)

On a call for cooling, thermostat makes R-O, R-Y, and R-G. Circuit R-O energizes reversing valve switching it to cooling position. Circuit R-Y sends low voltage through the safeties and energizes the contactor, which starts the compressor and energizes the T1 terminal on the circuit board. This will energize the OF2 fan relay which starts the outdoor fan motor.

When the cycle is complete, R-Y is turned off and compressor and outdoor fan should stop. With Carrier thermostats, the O terminal remains energized in the cooling mode. If the mode is switched to heat or Off, the valve is de-energized. There is no compressor delay built into this control.

Heating Sequence of Operation (KH32EA001)

On a call for heating, thermostat makes R-Y, and R-G. Circuit R-Y sends low voltage through the safeties and energizes the contactor, which starts the compressor and energizes the T1 terminal on the circuit board. The T1 terminal energizes the defrost logic. This will energize the OF2 fan relay start the outdoor motor. The T1 terminal must be energized for defrost to function.

When the cycle is complete, R-Y is turned off and the compressor and outdoor fan should stop. There is no compressor delay built into this control.

Defrost Sequence (HK32EA001/007)

The defrost control is a time/temperature control that has field selectable settings of 30, 60, and 90 minutes. These represent the amount of time that must pass after closure of the defrost thermostat before the defrost sequence begins.

The defrost thermostat senses coil temperature throughout the heating cycle. When the coil temperature reaches the defrost thermostat setting of approximately 32°F, it will close, which energizes the DFT terminal and begins the defrost timing sequence. When the DTF has been energized for the selected time, the defrost cycle begins, and the control shifts the reversing valve into cooling position, and turns the outdoor fan off. This shifts hot gas flow into the outdoor coil which melts the frost from the coil. The defrost cycle is terminated when defrost thermostat opens at approximately 65°F, or automatically after 10 minutes.

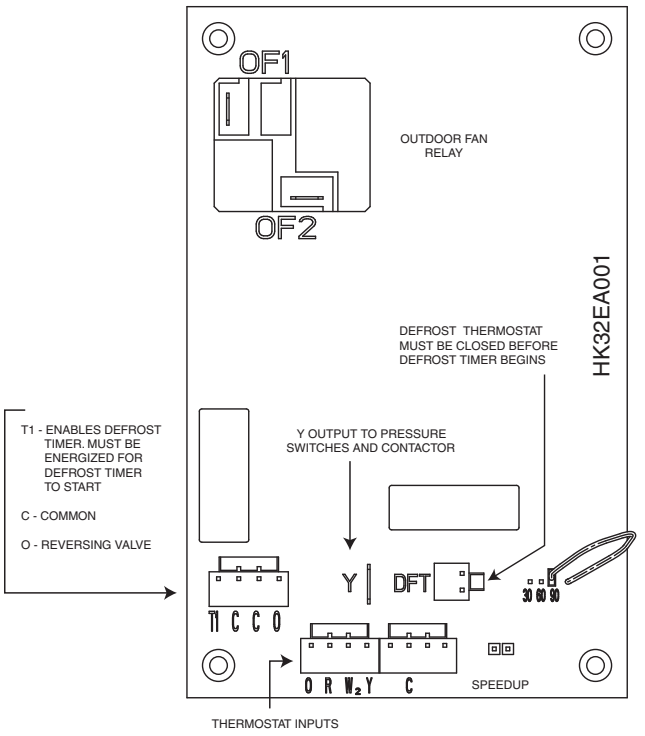

Fig. 9 – HK32EA001/007 Defrost Control

Troubleshooting (HK32EA001/007)

If outdoor unit will not run:

1. Does the Y input has 24 volts from thermostat? If not, check thermostat or wire. If yes proceed to #2
2. The Y spade terminal on the circuit board should have 24 volts if Y input is energized. This output goes through the pressure switches and to the contactor. If 24 volts is present on the Y spade terminal, and the contactor is not closed, check voltage on contactor coil. If no voltage is present, check for opened pressure switch.
3. If voltage is present and contactor is open, contactor may be defective. Replace contactor if necessary.
4. If contactor is closed and unit will still not run, check wiring, capacitor and compressor

Defrost Speedup (KH32EA001)

To test the defrost function on these units, speed up pins are provided on the circuit board. To force a defrost cycle, the defrost thermostat must be closed, or the defrost thermostat pins must be jumpered. Follow the steps below to force a defrost cycle:

1. Jumper the DFT input
2. Short the speed up pins. This speeds up the defrost timer by a factor of 256. The longer the defrost interval setting, the longer the pins must be shorted to speed through the timing. For example, if interval is 90 min, the speed up will take (90/256)min x (60seconds /minute)= 21 seconds max. This could be shorter depending on how much time has elapsed since the defrost thermostat closed.
3. Remove the short immediately when the unit shifts into defrost. Failure to remove the short immediately will result in a very short forced defrost cycle (the 10 minute timer will be sped through in 2 seconds)
4. When defrost begins, it will continue until the defrost thermostat opens or 10 minutes has elapsed.

NOTE: The T1 terminal on the defrost board powers the defrost timing function. This terminal must be energized before any defrost function will occur.

If defrost thermostat is stuck closed:

Whether the unit is in heating or cooling mode, it will run a defrost cycle for 10 minutes each time the compressor has been energized for the selected time interval. The board will terminate automatically after 10 minutes of defrost time regardless of defrost thermostat position.

If defrost thermostat is stuck open:

The unit will not defrost

NOTE: Unit will remain in defrost until defrost thermostat reopens at approximately 65°F coil temperature at liquid line or remainder of defrost cycle time.

5. Turn off power to outdoor unit and reconnect fan-motor lead to OF2 on control board after above forced-defrost cycle.

If unit will not defrost:

1. Perform the speedup function as described above to test the defrost function of the circuit board.
2. If the unit does not go into defrost after performing the speed up, check for 24 volts on the T1 terminal. This terminal powers the defrost circuit, and must be energized before any defrost function can occur. The T1 should be energized once the Y terminal is energized and the pressure switches are closed. Ensure the T1 wire is connected at the contactor, and that 24 volts is present on the T1 spade terminal.
3. If all voltages are present and unit will still not run defrost, remove thermostat pigtail harness from board and perform checks directly on input pins with jumper wires. The pigtail may have a bad connection or be mis-wired.

To fully troubleshoot defrost thermostat and control function (HK32EA001/007):

1. Turn thermostat to OFF. Shut off all power to outdoor unit.
2. Remove control box cover for access to electrical components and defrost control board.
3. Disconnect defrost thermostat leads from control board, and connect to ohmmeter. Thermostat leads are black, insulated wires connected to DFT and R terminals on control board. Resistance reading may be zero (indicating closed defrost thermostat), or infinity (∞ for open thermostat) depending on outdoor temperature.
4. Jumper between DFT and R terminals on control board as shown in Fig. 9.
5. Disconnect outdoor fan motor lead from OF2. Tape lead to prevent grounding.
6. Turn on power to outdoor unit.
7. Restart unit in heating mode, allowing frost to accumulate on outdoor coil.
8. After a few minutes in heating mode, liquid line temperature at defrost thermostat should drop below closing set point of defrost thermostat of approximately 32°F. Check resistance across defrost thermostat leads using ohmmeter. Resistance of zero indicates defrost thermostat is closed and operating properly.
9. Short between the speed-up terminals using a thermostat screwdriver. This reduces the timing sequence to 1/256 of original time. (See Table 3.)

Table 3—Defrost Control Speed-Up Timing Sequence

PARAMETER	MINIMUM (MINUTES)	MAXIMUM (MINUTES)	SPEED-UP (NOMINAL)
30-minute cycle	27	33	7 sec
60-minute cycle	56	66	14 sec
90-minute cycle	81	99	21 sec
10-minute cycle	9	11	2 sec
5-minutes	4.5	5.5	1 sec

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Exercise extreme caution when shorting speed-up pins. If pins are accidentally shorted to other terminals, damage to the control board will occur.

10. Unit is now operating in defrost mode. Check between C and W2 using voltmeter. Reading on voltmeter should indicate 24v. This step ensures defrost relay contacts have closed, energizing supplemental heat (W2) and reversing valve solenoid (O).
11. Unit should remain in defrost no longer than 10 minutes. Actual time in defrost depends on how quickly speed-up jumper is removed. If it takes 2 sec to remove speed-up jumper after unit has switched to defrost, the unit will switch back to heat mode.
12. After a few minutes, in defrost (cooling) operation, liquid line should be warm enough to have caused defrost thermostat contacts to open. Check resistance across defrost thermostat. Ohmmeter should read infinite resistance, indicating defrost thermostat has opened at approximately 65°F.
13. Shut off unit power and reconnect fan lead.

14. Remove jumper between DFT and R terminals. Reconnect defrost thermostat leads. Failure to remove jumper causes unit to switch to defrost every 30, 60, or 90 minutes and remain in defrost for full 10 minutes.
15. Replace control box cover. Restore power to unit.

If defrost thermostat does not check out following above items or incorrect calibration is suspected, check for defective thermostat as follows:

1. Follow items 1-5 above.
2. Route sensor or probe underneath coil (or other convenient location) using thermocouple temperature measuring device. Attach to liquid line near defrost thermostat. Insulate for more accurate reading.
3. Turn on power to outdoor unit.
4. Restart unit in heating.
5. Within a few minutes, liquid line temperature drops within a range causing defrost thermostat contacts to close. Temperature range is from 33°F to 27°F. Notice temperature at which ohmmeter reading goes from ∞ to zero ohms. Thermostat contacts close at this point.
6. Short between the speed-up terminals using a small slotted screwdriver.
7. Unit changes over to defrost within 21 sec (depending on timing cycle setting). Liquid line temperature rises to range where defrost thermostat contacts open. Temperature range is from 60°F to 70°F. Resistance goes from zero to ∞ when contacts are open.
8. If either opening or closing temperature does not fall within above ranges or thermostat sticks in 1 position, replace thermostat to ensure proper defrost operation.

NOTE: With timing cycle set at 90 minutes, unit initiates defrost within approximately 21 sec. When you hear the reversing valve changing position, remove screwdriver immediately. Otherwise, control will terminate normal 10-minute defrost cycle in approximately 2 sec.

HK32EA003 DEFROST CONTROL

The HK32EA003 defrost control is used in all Performance Series heat pumps with Puron refrigerant. Its features include selectable defrost intervals of 30, 60, 90, & 120 minutes, Quiet Shift, compressor time delay, deluxe defrost speed up capability. This section describes the sequence of operation and trouble shooting methods for this control.

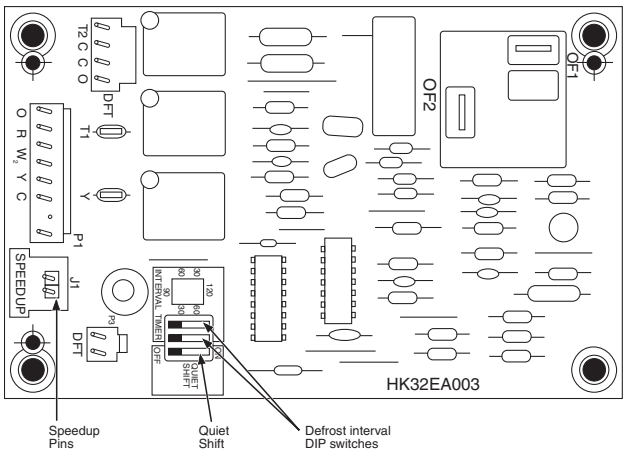

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Fig. 10 – HK32EA003 Defrost Control

Quiet Shift (HK32EA003)

This control has the option of shutting down the compressor for 30 seconds going in and coming out of defrost. This is accomplished by turning DIP switch 3 to the ON position. Factory default is in the OFF position. Enabling this feature eliminates occasional noise complaints associated with switching into and out of defrost.

Five-Minute Compressor Delay (HK32EA003)

This control features a 5-minute time delay to protect the compressor from short cycling. The delay begins counting when the low voltage is interrupted, and at the end of heating or cooling cycle.

System function and Sequence of operation (HK32EA003)

On power-up (24 volts between R-C) the 5 minute cycle timer begins counting down. The compressor will not be energized until this timer is elapsed.

Cooling

On a call for cooling, thermostat makes R-O, R-Y, and R-G. Circuit R-O energizes reversing valve switching it to cooling position. Circuit R-Y sends low voltage through the safeties and energizes the T1 terminal on the circuit board. If the compressor has been off for 5 minutes, or power has not been cycled for 5 minutes, the OF2 relay and T2 terminal will energize. This will close the contactor, start the outdoor fan motor and compressor.

When the cycle is complete, R-Y is turned off and compressor and outdoor fan should stop. When using Carrier thermostats, the reversing valve remains energized in the cooling mode until the thermostat is switched to heat, or the mode it turned off. The 5-minute time guard begins counting. Compressor will not come on again until this time delay expires. In the event of a power interruption, the time guard will not allow another cycle for 5 minutes.

Heating

On a call for heating, thermostat makes R-Y, and R-G. Circuit R-Y sends low voltage through the safeties and energizes the T1 terminal on the circuit board. T1 energizes the defrost logic circuit. If the compressor has been off for 5 minutes, or power has not been cycled for 5 minutes, the OF2 relay and T2 terminal will energize. This will close the contactor, start the outdoor fan motor and compressor.

When the cycle is complete, R-Y is turned off and the compressor and outdoor fan should stop. The 5 minute time guard begins counting. Compressor will not come on again until this time delay expires. In the event of a power interruption, the time guard will not allow another cycle for 5 minutes.

Defrost Sequence

The defrost control is a time/temperature control that has field selectable settings of 30, 60, 90 and 120 minutes. These represent the amount of time that must pass after closure of the defrost thermostat before the defrost sequence begins.

The defrost thermostat senses coil temperature throughout the heating cycle. When the coil temperature reaches the defrost thermostat setting of approximately 32 degrees F, it will close, which energizes the DFT terminal and begins the defrost timing sequence. When the DTF has been energized for the selected time, the defrost cycle begins. If the defrost thermostat opens before the timer expires, the timing sequence is reset.

Defrost cycle is terminated when defrost thermostat opens or automatically after 10 minutes.

Deluxe Defrost Speedup

To initiate a force defrost, speedup pins (J1) must be shorted with a flat head screwdriver for 5 seconds and RELEASED. If the defrost thermostat is open, a short defrost cycle will be observed (actual length depends on Quiet Shift switch position). When Quiet Shift is off, only a short 30 second defrost cycle is observed. With Quiet Shift ON, the speed up sequence is one minute; 30 second compressor off period followed by 30 seconds of defrost with compressor operation. When returning to heating mode, the compressor will turn off for an additional 30 seconds and the fan for 40 seconds.

If the defrost thermostat is closed, a complete defrost cycle is initiated. If the Quiet Shift switch is turned on, the compressor will be turned off for two 30 second intervals as explained previously.

Troubleshooting (HK32EA003)

If outdoor unit will not run:

1. Does the Y input have 24 volts from thermostat? If not, check thermostat or wire. If yes proceed to #2
2. The Y spade terminal should have 24 volts if Y input is energized. This output goes through the pressure switches and back to the T1 input to energize the time delay and defrost timing circuit. If the contactor is not closed, the time delay may still be active. Defeat time delay by shorting speed up pins for 1 second. Be sure not to short more than 1 second.
3. Once time delay has elapsed voltage on T2 should energize contactor. Check voltage on contactor coil. If no voltage is present, check for opened pressure switch.
4. If voltage is present and contactor is open, contactor may be defective. Replace contactor
5. If contactor is closed and unit will still not run, check capacitor and compressor.

If unit will not go into defrost:

1. Perform speedup function as described above to test the defrost function of the circuit board.
2. If the unit will go into defrost with the speed up, but will not on its own, the defrost thermostat may not be functioning properly. Perform the full defrost thermostat and board troubleshooting the same as described for the HK32EA001/007 control. Other than the Quiet shift (if selected), and the speedup timing, the troubleshooting process is identical.
3. If unit still will not run defrost, remove thermostat pigtail harness from board and perform checks directly on input pins with jumper wires. The pigtail may have a bad connection or be mis-wired.

HK32EA008 DEFROST CONTROL

The HK32EA008 defrost control is used in all non-communicating heat pumps and has all the same functionality, speedups, and troubleshooting as the HK32EA003 except for the forced defrost timing when Quiet Shift-2 is enabled.

Quiet Shift-2 (non-communicating)

Quiet shift-2 is a field selectable defrost mode (factory set to OFF), which will reduce the occasional noise that could be heard at the start of defrost cycle and restarting of heating cycle. It is selected by placing DIP switch 3 on defrost board in the ON position.

When Quiet Shift-2 switch is placed in ON position, and defrost is initiated, the following sequence of operation will occur: The compressor will be de-energized for approximately 1 minute, then the reversing valve will be energized. A few seconds later, the compressor will be re-energized and the normal defrost cycle starts. Once defrost termination conditions have been met, the following sequence will occur: The compressor will be de-energized for approximately 1 minute, then the reversing valve will be de-energized. A few seconds later, the compressor will be re-energized and the normal heating cycle starts.

Fan Motor

The fan motor rotates the fan blade that draws air through the outdoor coil to exchange heat between the refrigerant and the air. Motors are totally enclosed to increase reliability. This eliminates the need for a rain shield. For the correct position of fan blade assembly, the fan hub should be flush with the motor shaft. Replacement motors and blades may vary slightly.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Turn off all power before servicing or replacing fan motor. Be sure unit main power switch is turned off.

The bearings are permanently lubricated, therefore, no oil ports are provided.

For suspected electrical failures, check for loose or faulty electrical connections, or defective fan motor capacitor. Fan motor is equipped with thermal overload device in motor windings which may open under adverse operating conditions. Allow time for motor to cool so device can reset. Further checking of motor can be done with an ohmmeter. Set scale on R X 1 position, and check for continuity between 3 leads. Replace motors that show an open circuit in any of the windings. Place 1 lead of ohmmeter on each motor lead. At same time, place other ohmmeter lead on motor case (ground). Replace any motor that shows resistance to ground, arcing, burning, or overheating.

Compressor Plug

The compressor electrical plug provides a quick-tight connection to compressor terminals. The plug completely covers the compressor terminals and the mating female terminals are completely encapsulated in plug. Therefore, terminals are isolated from any moisture so corrosion and resultant pitted or discolored terminals are reduced. The plug is oriented to relief slot in terminal box so cover cannot be secured if wires are not positioned in slot, assuring correct electrical connection at the compressor. The plug can be removed by simultaneously pulling while “rocking“ plug. However, these plugs can be used only on specific compressors. The configuration around the fusite terminals is outlined on the terminal covers. The slot through which wires of plug are routed is oriented on the bottom and slightly to the left. The correct plug can be connected easily to compressor terminals and plug wires can easily be routed through slot terminal cover.

It is strongly recommended to replace the compressor plug should a compressor fail due to a suspected electrical failure. At a minimum, inspect plug for proper connection and good condition on any compressor replacement.

Low-Voltage Terminals

The low-voltage terminal designations, and their description and function, are used on all split-system condensers.

W—Energizes first-stage supplemental heat through defrost relay (wht).

R—Energizes 24-v power from transformer (red).

Y—Energizes contactor for first-stage cooling or first-stage heating for heat pumps (yel).

O—Energizes reversing valve on heat pumps (orn).

C—Common side of transformer (blk).

COPELAND SCROLL COMPRESSOR

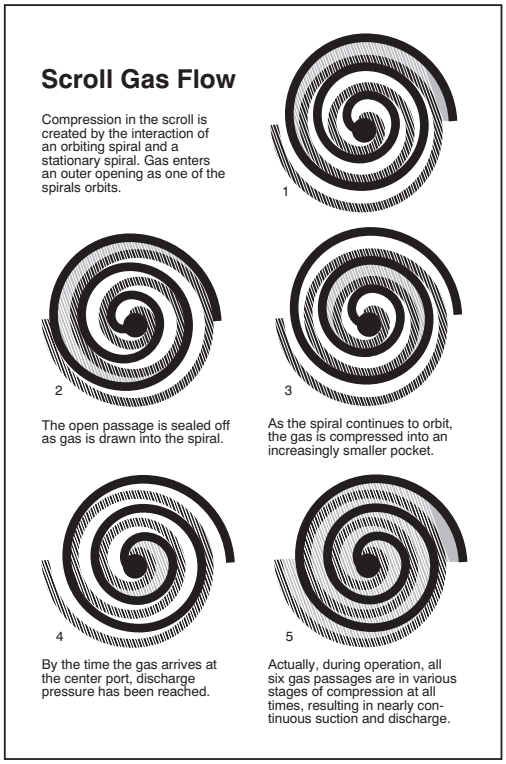

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Fig. 11 – Scroll Compressor Refrigerant Flow

The compressors used in these products are specifically designed to operate with designated refrigerant and cannot be interchanged. The compressor is an electrical (as well as mechanical) device. Exercise extreme caution when working near compressors. Power should be shut off, if possible, for most troubleshooting techniques. Refrigerants present additional safety hazards.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant.

The scroll compressor pumps refrigerant through the system by the interaction of a stationary and an orbiting scroll. (See Fig. 11.) The scroll compressor has no dynamic suction or discharge valves, and it is more tolerant of stresses caused by debris, liquid slugging, and flooded starts. The compressor is equipped with an internal pressure relief port. The pressure relief port is a safety device, designed to protect against extreme high pressure. The relief port has an operating range between 550 to 625 psi differential pressure for Puron® and 350 to 450 psi differential pressure for R-22. Scrolls have a variety of shut down solutions, depending on model, to prevent backward rotation and eliminate the need for cycle protection.

LG SCROLL COMPRESSOR

The compressors used in these products are specifically designed to operate with designated refrigerants and cannot be interchanged.

LG produced scroll compressors are designed to operate and function as the typical orbiting scroll on a fixed scroll design. Refrigerant flow and compression is basically the same.

Characteristics of the LG Scroll Compressor:

Internal Motor Overload Protection (OLP): This is an inherent protection system sensing both motor winding temperature and motor current. This is designed to open the common wire on single phase units and stop the motor operation if motor high temperature or over current conditions exist. Trip of the OLP opens the common line.

Vacuum protection device: If the suction side of the compressor is blocked or limited, an extremely low vacuum situation is formed by the optimum efficiency of the scrolls. The high vacuum pressure causes the arc at the internal power terminal and cause tripping of the internal overload or breaker or damage to the compressor. This compressor is equipped with internal protection that opens if this high vacuum condition exists and bypasses high pressure gas to the low pressure and the internal overload may trip. In the case of refrigerant pump down, the unit can operate with pump down but this protection may not allow the refrigerant to be pumped down completely.

Internal Pressure Relief (IPR): The internal pressure relief is located between the high and low pressure of the compressor and is designed to open when the difference of the suction and discharge pressure is (55-550 psid (35.1-38.7 kg/cm2). When the IPR valve opens, the high temperature gas bypasses into the motor area and will trip the motor OLP.

Quiet Shut Down Device: The LG scroll has a shut down device to efficiently minimize the shut down sound. The reversing sound is minimized by a check valve located in the discharge port of the scroll sets. This slows the equalization of the high side to low side upon shut down to prevent the scrolls from operating backwards.

Discharge Temperature Protection: The compressor discharge temperature is monitored by a temperature sensor mounted on the top cap of the compressor. Wire diagrams may refer to this as a discharge temperature switch (DTS). This is to protect against excessively high scroll temperatures due to loss of charge or operating outside the compressor envelope. This temperature sensor opens to stop the compressor if temperatures exceed 239-257°F (115-125°C) and resets at 151-187°F (66-86°C). The DTS will break the Y signal in the 24 volt circuit if it trips open.

Test sensor wires for continuity, open above 239-257F°F (115-125°C) and resets at 151-187°F (66-86°C).

If replacement is deemed necessary, perform the following to replace sensor:

1. Locate top cap and discharge temperature sensor

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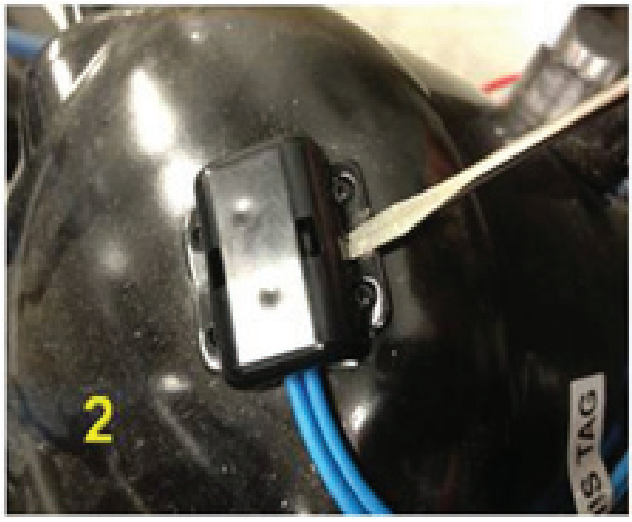
2. Carefully remove sensor cover



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3. Expose the sensor holder

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4. Slide out the sensor, slide in replacement and reinstall the cover

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COMPRESSOR TROUBLESHOOTING

Compressor Failures

Compressor failures are classified in 2 broad failure categories; mechanical and electrical. Both types are discussed below.

Mechanical Failures

A compressor is a mechanical pump driven by an electric motor contained in a welded or hermetic shell. In a mechanical failure, motor or electrical circuit appears normal, but compressor does not function normally.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Do not supply power to unit with compressor terminal box cover removed.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Exercise extreme caution when reading compressor currents when high-voltage power is on. Correct any of the problems described below before installing and running a replacement compressor.

Locked Rotor

In this type of failure, compressor motor and all starting components are normal. When compressor attempts to start, it draws locked rotor current and cycles off on internal protection. Locked rotor current is measured by applying a clamp-on ammeter around common (blk) lead of compressor. Current drawn when it attempts to start is then measured. Locked rotor amp (LRA) value is stamped on compressor nameplate.

If compressor draws locked rotor amps and all other external sources of problems have been eliminated, compressor must be replaced. Because compressor is a sealed unit, it is impossible to determine exact mechanical failure. However, complete system should be checked for abnormalities such as incorrect refrigerant charge, restrictions, insufficient airflow across indoor or outdoor coil, etc., which could be contributing to the failure.

Runs, Does Not Pump

In this type of failure, compressor motor runs and turns compressor, but compressor does not pump refrigerant. A clamp-on ampmeter on common leg shows a very low current draw, much lower than rated load amp (RLA) value stamped on compressor nameplate. Because no refrigerant is being pumped, there is no return gas to cool compressor motor. It eventually overheats and shuts off on its internal protection.

Noisy Compressor

Noise may be caused by a variety of internal and external factors. Careful attention to the "type" of noise may help identify the source. The following are some examples of abnormal conditions that may create objectionable noise:

1. A gurgling sound may indicate a liquid refrigerant floodback during operation. This could be confirmed if there is no compressor superheat. A compressor superheat of "0" degrees would indicate liquid refrigerant returning to the compressor. Most common reasons for floodback are: loss of evaporator blower, dirty coils, and improper airflow.
2. A rattling noise may indicate loose hardware. Inspect all unit hardware including the compressor grommets.
3. A straining (hard start) or vibration occurring at start up but clears quickly after could indicate an off cycle refrigerant migration issue. Refrigerant migration can occur when a compressor is off and refrigerant vapor transfers from other areas of the system, settles into the compressor as it is attracted to the oil, and then condenses into the oil. Upon start up, the compressor draws suction from within itself first and lowers the boiling point of the refrigerant that is entrained in the oil. This can cause the liquid refrigerant and oil to boil into the compression area or liquid refrigerant to wipe off oil films that are critical for proper lubrication. Migration is worsened by greater temperature differentials and/or extra refrigerant in the system. Prevention of migration can be reduced by various options but some of the more common remedies is to verify proper charge and add a crankcase heater where this situation is suspected.
4. Operational vibration could indicate a charge issue. Verify charge and ensure proper piping and structural penetration insulation. Tubing that is too rigid to building rafters without proper insulation could transfer noise throughout the structure. On some occasions a sound dampener or mass weight (RCD part no. 328209-751) placed on the vibrating tubing has been known to reduce this noise. Utilizing compressor split post grommets (see Fig. 12) may also reduce this vibration if piping cannot be remedied.
5. An operational high pitch frequency or "waa waa" sound that appears to resonate through the suction line could indicate a need to add more flex or muffling in the lines. This has been occasional in scroll compressor applications and is usually remedied by adding a field-fabricated suction line loop (see Fig. 13). Reciprocating compressors may have a noticeable discharge pulsation that could be remedied with a field installed discharge muffler. Recommend loop by continuous tubing with no more than 12 inches vertical and 6 inch horizontal loop.
6. An internal "thunking", "thumping", "grinding" or "rattling" noise could indicate compressor internal failures and may be verified by comparing the compressor amperage to what the compressor should be drawing according to a manufacturer's performance data.
7. A whistling or squealing noise during operation may indicate a partial blockage of the refrigerant charge.
8. A whistle on shut down could indicate a partial leak path as refrigerant is equalizing from high to low side. On occasion, an in-line discharge check valve has prevented this sound.

9. If a compressor hums but won't start it could indicate either a voltage or amperage issue. Verify adequate voltage and operational start components if installed. If it is drawing excessive amperage and voltage doesn't appear to be the problem it may be assumed a locked condition. Ensure refrigerant has had ample time to equalize and boil out of the compressor before condemning.
10. When a heat pump switches into and out of defrost, a "swooshing" noise is expected due to the rapid pressure change within the system. However customers sometimes complain that the noise is excessive, or it is sometimes accompanied by a "groaning, or howling" noise. When receiving these complaints, Quiet Shift- 2 (if available) may improve the noise, but will probably not eliminate it totally. Check that the defrost thermostat or thermistor is operating properly. Insulating the defrost sensing device may also help. If the howling or groaning noise is intermittent, replacing the reversing valve may or may not help.
11. Rattling that occurs during a shift into or out of defrost on a heat pump could indicate a pressure differential issue. This is usually a brief occurrence (under 60 seconds) and can be remedied by incorporating Quiet Shift- 2, if available. This is a device that shuts down the compressor during the defrost shift for approximately 1 minute allowing the pressures to equalize. It is enabled by either a dip switch setting on the defrost board, or in the User Interface on communicating systems. Verify proper system charge as well.

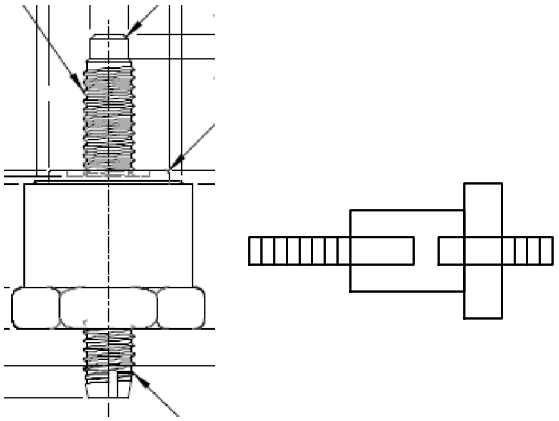

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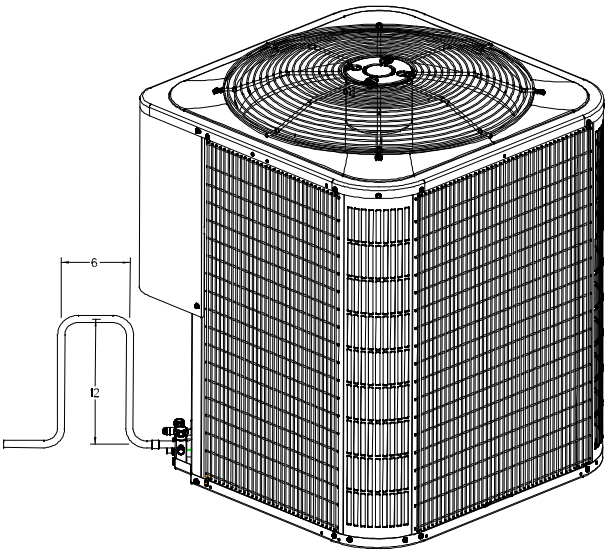
Fig. 12 – Split Post Grommet part number: KA75UG100



Note: Long radius elbows recommended

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Fig. 13 – Suction Line Loop

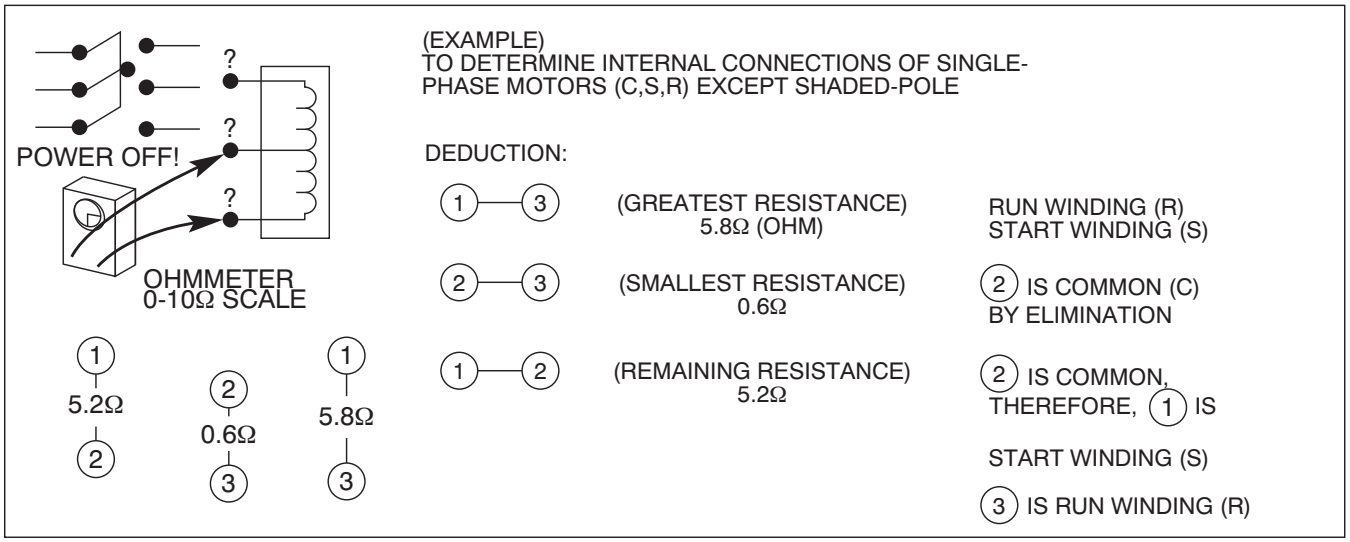

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Fig. 14 – Identifying Compressor Terminals

Electrical Failures

The compressor mechanical pump is driven by an electric motor within its hermetic shell. In electrical failures, compressor does not run although external electrical and mechanical systems appear normal. Compressor must be checked electrically for abnormalities.

Before troubleshooting compressor motor, review this description of compressor motor terminal identification.

Single-Phase Motors

To identify terminals C, S, and R:

1. Turn off all unit power.
2. Discharge run and start capacitors to prevent shock.
3. Remove all wires from motor terminals.
4. Read resistance between all pairs of terminals using an ohmmeter on 0-10 ohm scale.
5. Determine 2 terminals that provide greatest resistance reading.

Through elimination, remaining terminal must be common (C). Greatest resistance between common (C) and another terminal indicates the start winding because it has more turns. This terminal is the start (S). The remaining terminal will be run winding (R).

NOTE: If compressor is hot, allow time to cool and internal line break to reset. There is an internal line break protector which must be closed.

All compressors are equipped with internal motor protection. If motor becomes hot for any reason, protector opens. Compressor should always be allowed to cool and protector to close before troubleshooting. Always turn off all power to unit and disconnect leads at compressor terminals before taking readings.

Most common motor failures are due to either an open, grounded, or short circuit. When a compressor fails to start or run, 3 tests can help determine the problem. First, all possible external causes should be eliminated, such as overloads, improper voltage, pressure equalization, defective capacitor(s), relays, wiring, etc. Compressor has internal line break overload, so be certain it is closed.

Open Circuit

⚠ WARNING

UNIT PERSONAL INJURY HAZARD

Failure to follow this warning could result in personal injury.

Use caution when working near compressor terminals. Damaged terminals have the potential to cause personal injury.

Never put face or body directly in line with terminals.

To determine if any winding has a break in the internal wires and current is unable to pass through, follow these steps:

1. Be sure all power is off.
2. Discharge all capacitors.
3. Remove wires from terminals C, S, and R.
4. Check resistance from C-R, C-S, and R-S using an ohmmeter on 0-1000 ohm scale.

Because winding resistances are usually less than 10 ohms, each reading appears to be approximately 0 ohm. If resistance remains at 1000 ohms, an open or break exists and compressor should be replaced.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Be sure internal line break overload is not temporarily open.

Ground Circuit

To determine if a wire has broken or come in direct contact with shell, causing a direct short to ground, follow these steps:

1. Allow crankcase heaters to remain on for several hours before checking motor to ensure windings are not saturated with refrigerant.
2. Using an ohmmeter on R X 10,000 ohm scale or megohmmeter (follow manufacturer's instructions).
3. Be sure all power is off.
4. Discharge all capacitors.
5. Remove wires from terminals C, S, and R.
6. Place one meter probe on ground or on compressor shell. Make a good metal-to-metal contact. Place other probe on terminals C, S, and R in sequence.
7. Note meter scale.
8. If reading of 0 or low resistance is obtained, motor is grounded. Replace compressor.

Compressor resistance to ground should not be less than 1000 ohms per volt of operating voltage.

Example:

230 volts X 1000 ohms/volt = 230,000 ohms minimum.

Short Circuit

To determine if any wires within windings have broken through their insulation and made contact with other wires, thereby shorting all or part of the winding(s), be sure the following conditions are met.

1. Correct motor winding resistances must be known before testing, either from previous readings or from manufacturer's specifications.
2. Temperature of windings must be as specified, usually about 70°F.
3. Resistance measuring instrument must have an accuracy within ± 5-10 percent. This requires an accurate ohmmeter such as a Wheatstone bridge or null balance-type instrument.
4. Motor must be dry or free from direct contact with liquid refrigerant.

Make This Critical Test

(Not advisable unless above conditions are met)

1. Be sure all power is off.
2. Discharge all capacitors.
3. Remove wires from terminals C, S, and R.
4. Place instrument probes together and determine probe and lead wire resistance.
5. Check resistance readings from C-R, C-S, and R-S.
6. Subtract instrument probe and lead resistance from each reading.

If any reading is within ±20 percent of known resistance, motor is probably normal. Usually a considerable difference in reading is noted if a turn-to-turn short is present.

REFRIGERATION SYSTEM

Refrigerant

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Puron® refrigerant which has higher pressures than R-22 and other refrigerants. No other refrigerant may be used in this system. Gauge set, hoses, and recovery system must be designed to handle Puron®. If you are unsure consult the equipment manufacturer.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

The compressor in a Puron® system uses a polyol ester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

In an air conditioning and heat pump system, refrigerant transfers heat from one replace to another. The condenser is the outdoor coil in the cooling mode and the evaporator is the indoor coil.

In a heat pump, the condenser is the indoor coil in the heating mode and the evaporator is the outdoor coil.

In the typical air conditioning mode, compressed hot gas leaves the compressor and enters the condensing coil. As gas passes through the condenser coil, it rejects heat and condenses into liquid. The liquid leaves condensing unit through liquid line and enters metering device at evaporator coil. As it passes through metering device, it becomes a gas-liquid mixture. As it passes through indoor coil, it absorbs heat and the refrigerant moves to the compressor and is again compressed to hot gas, and cycle repeats.

Servicing Systems on Roofs With Synthetic Materials

POE (polyol ester) compressor lubricants are known to cause long term damage to some synthetic roofing materials. Exposure, even if immediately cleaned up, may cause embrittlement (leading to cracking) to occur in one year or more. When performing any service which may risk exposure of compressor oil to the roof, take appropriate precautions to protect roofing. Procedures which risk oil leakage include but are not limited to compressor replacement, repairing refrigerants leaks, replacing refrigerant components such as filter drier, pressure switch, metering device, coil, accumulator, or reversing valve.

Synthetic Roof Precautionary Procedure

1. Cover extended roof working area with an impermeable polyethylene (plastic) drop cloth or tarp. Cover an approximate 10 x 10 ft area.
2. Cover area in front of the unit service panel with a terry cloth shop towel to absorb lubricant spills and prevent run-offs, and protect drop cloth from tears caused by tools or components.
3. Place terry cloth shop towel inside unit immediately under component(s) to be serviced and prevent lubricant run-offs through the louvered openings in the base pan.
4. Perform required service.
5. Remove and dispose of any oil contaminated material per local codes.

Brazing

This section on brazing is not intended to teach a technician how to braze. There are books and classes which teach and refine brazing techniques. The basic points below are listed only as a reminder.

Definition: The joining and sealing of metals using a nonferrous metal having a melting point over 800°F/426.6°C.

Flux: A cleaning solution applied to tubing or wire before it is brazed. Flux improves the strength of the brazed connection.

When brazing is required in the refrigeration system, certain basics should be remembered. The following are a few of the basic rules.

1. Clean joints make the best joints. To clean:
   - — Remove all oxidation from surfaces to a shiny finish before brazing.
   - — Remove all flux residue with brush and water while material is still hot.
2. Silver brazing alloy is used on copper-to-brass, copper-to-steel, or copper-to-copper. Flux is required when using silver brazing alloy. Do not use low temperature solder.
3. Fluxes should be used carefully. Avoid excessive application and do not allow fluxes to enter into the system.
4. Brazing temperature of copper is proper when it is heated to a minimum temperature of 800°F and it is a dull red color in appearance.

Aluminum Brazing

This field repair procedure is intended for aluminum coil product group that have acquired mechanical damage. This procedure is limited to repairing self-tapping screw holes and punctures, not to exceed 0.182” along its largest axis if non circular, and 0.182” diameter if circular.

Coil replacement is needed if at least one of the following is present:

- Brazing kit p/n 337748-751
- Corrosion cracks and burst cracks
- A singular tube with more than 2 holes
- Holes that exceed .182” largest axis if non circular and .182” dia. If circular.

The key to brazing aluminum is watching the flame change in color. Any fuel gas/oxygen flame in the neutral state will produce a flame that is a shade of blue. As the aluminum heats up to temperature, you will see the flame change in color to red/orange.

The change in color indicates the base metal is at temperature ready for braze material. Continuing to apply heat will not change the color and will melt the base metal.

The braze alloys should not have direct contact with the flame. In cored wire filler metals, you will notice that the filler metal will melt away exposing the flux. The flux change in state is from white liquid, to dry white, to clear liquid. The change in state of flux coincides with the flame change in color. The addition of flux will minimize the flame change in color. The alloy is ready to apply when the flux is in the clear state.

Most aluminum alloys melt at 1200°F, and the braze materials melt between 905°F and 1080°F. The zinc alloys (ZA-1) melt at a lower temperature while alloys which have more aluminum content melt at a higher temperature.

Materials:

1. 78/22 braze alloy Channel Flux ZA-1, Harris AlGroove900 cored wire
2. Flux CX-60 Omni / Lucas product
3. Stainless steel wire brushes small handle / rotary brush
4. Turbo-Torch equipment

Aluminum Brazing Instructions:

1. Clean area to be brazed
   a. Joint must be free of oil, grease, rust, corrosion, and refrigerant.
2. Wire brush to remove oxides from area
3. Flux area if required with the CX-60 flux. Cored wire alloys will not need fluxing.
   a. Additional flux with cored filler will aid in dirty conditions
4. Depending on thickness of material, select an appropriate torch tip size.
   a. Turbo torch standard nozzles work well for aluminum repair
   NOTE: It is important to size the torch tip to the thickness of material. Example: too large a torch tip will melt the aluminum base metal before you are able to repair it.
5. Heat area until flux turns clear or you see flame change in color.
6. Continue to heat the joint and test by wiping the braze rod across the joint.
7. Once the alloy melts on the parent metal add alloy to repair the area. **Maintain joint temperature** until repair is complete. **Do not over heat. (withdraw torch as required)**
8. It is best to repair the area the first time. Reheating can cause failure to repair the area.
9. If reheating is necessary, let joint cool, wire brush, reapply flux. Reheat joint so flux melts and reapply braze material.

Service Valves and Pumpdown

⚠ WARNING

PERSONAL INJURY AND UNIT DAMAGE HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Never attempt to make repairs to existing service valves. Unit operates under high pressure. Damaged seats and o-rings should not be replaced. Replacement of entire service valve is required. Service valve must be replaced by properly trained service technician.

Service valves provide a means for holding original factory charge in outdoor unit prior to hookup to indoor coil. They also contain gauge ports for measuring system pressures and provide shutoff convenience for certain types of repairs. (See Fig. 15.)

Front-seating service valves are used in outdoor residential equipment. This valve has a service port that contains a Schrader fitting. The service port is always pressurized after the valve is moved off the front-seat position.

The service valves used in the outdoor units come from the factory front-seated. This means that the refrigerant charge is isolated from the line-set connection ports. All heat pumps are shipped with an adapter stub tube. This tube must be installed on the liquid service valve. After connecting the stub tube to the liquid service valve of a heat pump, the valves are ready for brazing. The interconnecting tubing (line set) can be brazed to the service valves using industry accepted methods and materials. Consult local codes.

Before brazing the line set to the valves, the belled ends of the sweat connections on the service valves must be cleaned so that no brass plating remains on either the inside or outside of the bell joint. To prevent damage to the valve and/or cap "O" ring, use a wet cloth or other acceptable heat-sinking material on the valve before brazing. To prevent damage to the unit, use a metal barrier between brazing area and unit.

After the brazing operation and the refrigerant tubing and evaporator coil have been evacuated, the valve stem can be turned counterclockwise until back-seats, which releases refrigerant into tubing and evaporator coil. The system can now be operated.

Back-seating service valves must be back-seated (turned counterclockwise until seated) before the service-port caps can be removed and hoses of gauge manifold connected. In this position, refrigerant has access from and through outdoor and indoor unit.

The service valve-stem cap is tightened to 20 ± 2 ft/lb torque and the service-port caps to 9 ± 2 ft/lb torque. The seating surface of the valve stem has a knife-set edge against which the caps are tightened to attain a metal-to-metal seal. If accessory pressure switches are used, the service valve must be cracked. Then, the knife-set stem cap becomes the primary seal.

The service valve cannot be field repaired; therefore, only a complete valve or valve stem and service-port caps are available for replacement.

If the service valve is to be replaced, a metal barrier must be inserted between the valve and the unit to prevent damaging the unit exterior from the heat of the brazing operations.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant.

Pumpdown Procedure

Service valves provide a convenient shutoff valve useful for certain refrigeration-system repairs. System may be pumped down to make repairs on low side without losing complete refrigerant charge.

1. Attach pressure gauge to suction service-valve gauge port.
2. Front seat liquid-line valve.
3. Start unit in cooling mode. Run until suction pressure reaches 5 psig (35kPa). Do not allow compressor to pump to a vacuum.
4. Shut unit off. Front seat suction valve.

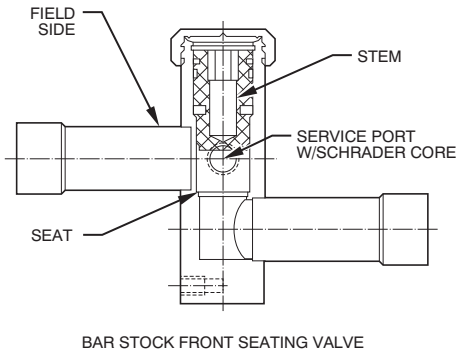

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Fig. 15 – Suction Service Valve (Front Seating) Used in Base and Comfort ACs and HPs

NOTE: All outdoor unit coils will hold only factory-supplied amount of refrigerant. Excess refrigerant, such as in long-line applications, may cause unit to relieve pressure through internal pressure-relief valve (indicated by sudden rise of suction pressure) before suction pressure reaches 5 psig (35kPa). If this occurs, shut unit off immediately, front seat suction valve, and recover remaining pressure.

Heating Piston (AccuRater®) - Heat Pumps Only

In this product line, AccuRater pistons are used to meter refrigerant for heat pump heating mode only. All indoor coils are supplied with a bi-flow TXV for metering in the cooling mode. AccuRater® piston has a refrigerant metering hole through it. The piston seats against the meters refrigerant in to the outdoor coil in heating and allows refrigerant to flow around it in cooling mode.

There are 2 types of liquid line connections used. Flare connections are used in R-22 systems.

1. Shut off power to unit.
2. Pump unit down using pumpdown procedure described in this service manual.
3. Loosen nut and remove liquid line flare connection from AccuRater®.
4. Pull retainer out of body, being careful not to scratch flare sealing surface. If retainer does not pull out easily, carefully use locking pliers to remove it.
5. Slide piston and piston ring out by inserting a small soft wire with small kinks through metering hole. Do not damage metering hole, sealing surface around piston cones, or fluted portion of piston.
6. Clean piston refrigerant metering hole.
7. Install a new retainer O-ring, retainer assembly, or Teflon washer before reassembling AccuRater®.

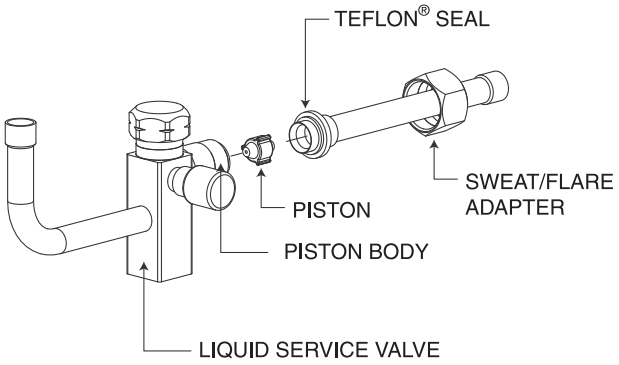

Fig. 16 – Front Seating Service Valve with Chatleff Connection Used in Base, Comfort, and 4-Sided Performance and Infinity Puron Heat Pumps.

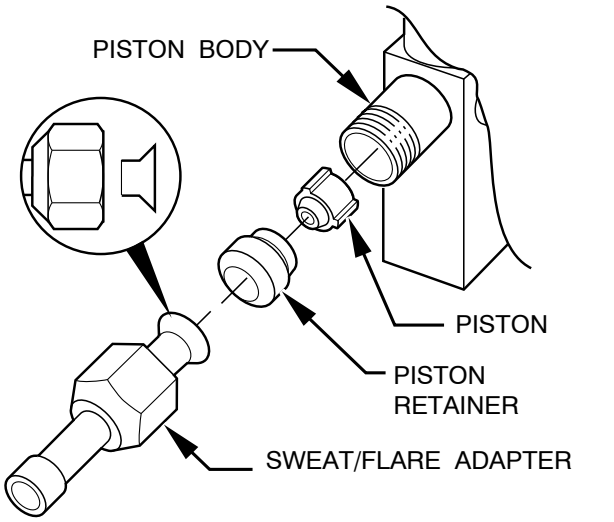

Fig. 17 – AccuRater® Components (used in R-22 Heat Pumps)

Reversing Valve

In heat pumps, changeover between heating and cooling modes is accomplished with a valve that reverses flow of refrigerant in system. This reversing valve device is easy to troubleshoot and replace. The reversing valve solenoid can be checked with power off with an ohmmeter. Check for continuity and shorting to ground. With control circuit (24v) power on, check for correct voltage at solenoid coil. Check for overheated solenoid.

With unit operating, other items can be checked, such as frost or condensate water on refrigerant lines.

The sound made by a reversing valve as it begins or ends defrost is a "whooshing" sound, as the valve reverses and pressures in system equalize. An experienced service technician detects this sound and uses it as a valuable troubleshooting tool.

Using a remote measuring device, check inlet and outlet line temperatures. **DO NOT** touch lines. If reversing valve is operating normally, inlet and outlet temperatures on appropriate lines should be close to each other. Any difference would be due to heat loss or gain across valve body. Temperatures are best checked with a remote reading electronic-type thermometer with multiple probes. Route thermocouple leads to inside of coil area through service valve mounting plate area underneath coil. Fig. 18 and Fig. 19 show test points (TP) on reversing valve for recording temperatures. Insulate points for more accurate reading.

If valve is defective:

1. Shut off all power to unit and remove charge from system.
2. Remove solenoid coil from valve body. Remove valve by cutting it from system with tubing cutter. Repair person should cut in such a way that stubs can be easily re-brazed back into system. Do not use hacksaw. This introduces chips into system that cause failure. After defective valve is removed, wrap it in wet rag and carefully unbraze stubs. Save stubs for future use. Because defective valve is not overheated, it can be analyzed for cause of failure when it is returned.
3. Braze new valve onto used stubs. Keep stubs oriented correctly. Scratch corresponding matching marks on old valve and stubs and on new valve body to aid in lining up new valve properly. When brazing stubs into valve, protect valve body with wet rag to prevent overheating.
4. Use slip couplings to install new valve with stubs back into system. Even if stubs are long, wrap valve with a wet rag to prevent overheating.
5. After valve is brazed in, check for leaks. Evacuate and charge system. Operate system in both modes several times to be sure valve functions properly.

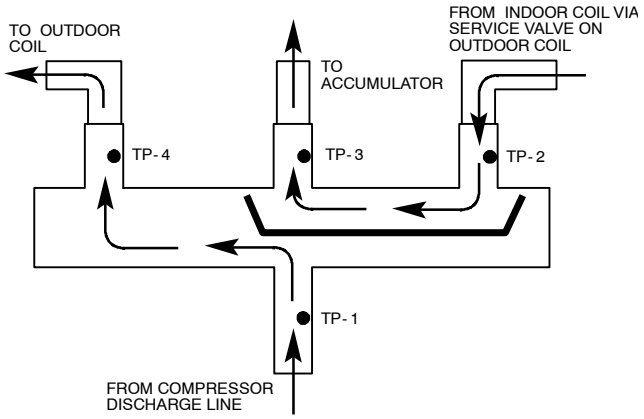

Fig. 18 – Reversing Valve (Cooling Mode or Defrost Mode, Solenoid Energized)

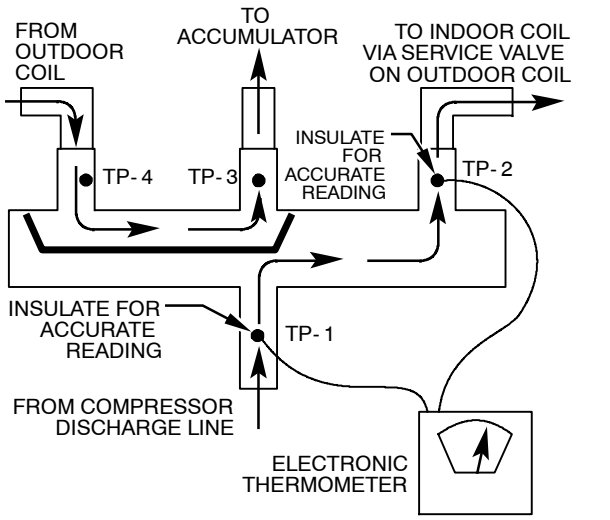

Fig. 19 – Reversing Valve (Heating Mode, Solenoid De-Energized)

Liquid Line Filter Drier

Filter driers are specifically designed for R-22 or Puron® refrigerant. Only operate with the appropriate drier using factory authorized components.

It is recommended that the liquid line drier be installed at the indoor unit. Placing the drier near the TXV allows additional protection to the TXV as the liquid line drier also acts as a strainer.

Install Liquid-line Filter Drier Indoor - AC

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

To avoid performance loss and compressor failure, installation of filter drier in liquid line is required.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

To avoid filter drier damage while brazing, filter drier must be wrapped in a heat-sinking material such as a wet cloth.

Refer to Fig. 20 and install filter drier as follows:

1. Braze 5-in. liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to above 5" liquid tube. Flow arrow must point towards indoor coil.
4. Connect and braze liquid refrigerant tube to the filter drier.

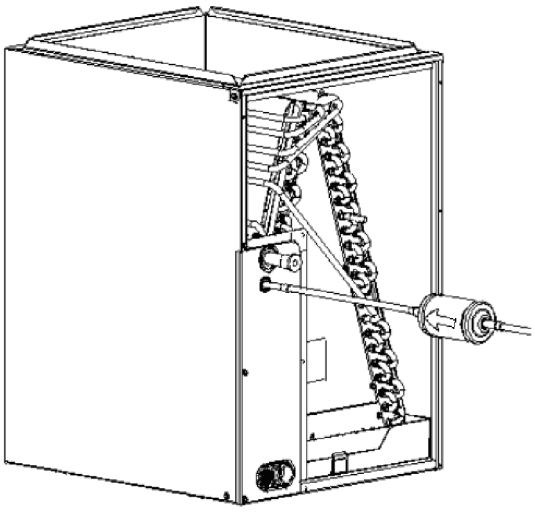

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Fig. 20 – Liquid Line Filter Drier - AC

Install Liquid-line Filter Drier Indoor - HP

Refer to Fig. 21 and install filter drier as follows:

1. Braze 5 in. liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to 5 in. long liquid tube from step 1.
4. Connect and braze liquid refrigerant tube to the filter drier.

Suction Line Filter Drier

The suction line drier is specifically designed to operate with Puron®, use only factory authorized components. Suction line filter drier is used in cases where acid might occur, such as burnout. Heat pump units must have the drier installed between the compressor and accumulator only. Remove after 10 hours of operation. Never leave suction line filter drier in a system longer than 72 hours (actual time).

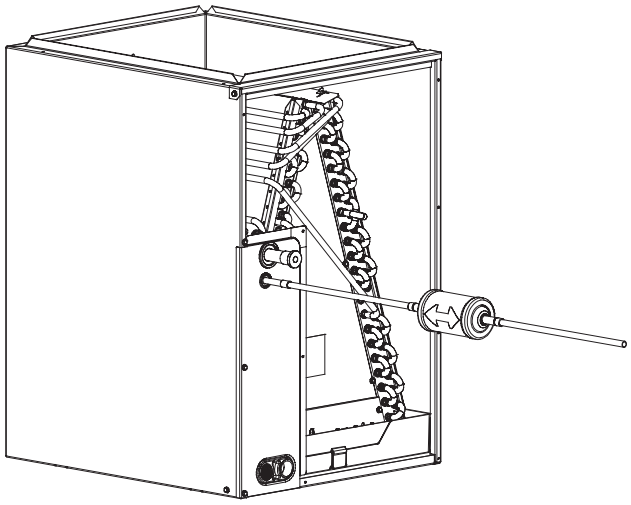

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Fig. 21 – Liquid Line Filter Drier - HP

Accumulator

The accumulator is specifically designed to operate with Puron® or R22 respectfully; use only factory-authorized components. Under some light load conditions on indoor coils, liquid refrigerant is present in suction gas returning to compressor. The accumulator stores liquid and allows it to boil off into a vapor so it can be safely returned to compressor. Since a compressor is designed to pump refrigerant in its gaseous state, introduction of liquid into it could cause severe damage or total failure of compressor.

The accumulator is a passive device which seldom needs replacing. Occasionally its internal oil return orifice or bleed hole may become plugged. Some oil is contained in refrigerant returning to compressor. It cannot boil off in accumulator with liquid refrigerant. The bleed hole allows a small amount of oil and refrigerant to enter the return line where velocity of refrigerant returns it to compressor. If bleed hole plugs, oil is trapped in accumulator, and compressor will eventually fail from lack of lubrication. If bleed hole is plugged, accumulator must be changed. The accumulator has a fusible element located in the bottom end bell. (See Fig. 22.) This fusible element will melt at 430°F//221°C and vent the refrigerant if this temperature is reached either internal or external to the system. If fuse melts, the accumulator must be replaced.

To change accumulator:

1. Shut off all power to unit.
2. Recover all refrigerant from system.
3. Break vacuum with dry nitrogen. Do not exceed 5 psig.

NOTE: Coil may be removed for access to accumulator. Refer to appropriate sections of Service Manual for instructions.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant.

4. Remove accumulator from system with tubing cutter.
5. Tape ends of open tubing.
6. Scratch matching marks on tubing studs and old accumulator. Scratch matching marks on new accumulator. Unbraze stubs from old accumulator and braze into new accumulator.
7. Thoroughly rinse any flux residue from joints and paint with corrosion-resistant coating such as zinc-rich paint.
8. Install factory authorized accumulator into system with copper slip couplings.
9. Evacuate and charge system.

Pour and measure oil quantity (if any) from old accumulator. If more than 20 percent of oil charge is trapped in accumulator, add new POE oil to compressor to make up for this loss.

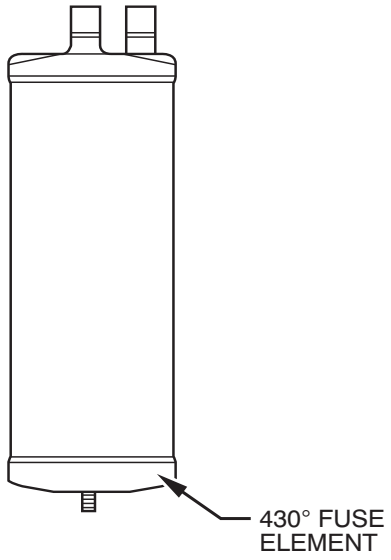

Fig. 22 – Accumulator

Thermostatic Expansion Valve (TXV)

All fan coils and furnace coils will have a factory installed thermostatic expansion valve (TXV). The TXV will be a bi-flow, hard-shutoff with an external equalizer and a balance port pin. A hard shut-off TXV does not have a bleed port. Therefore, minimal equalization takes place after shutdown. TXVs are specifically designed to operate with Puron® or R-22 refrigerant, use only factory authorized TXV's. **Do not interchange Puron and R-22 TXVs.**

TXV Operation

The TXV is a metering device that is used in air conditioning and heat pump systems to adjust to changing load conditions by maintaining a preset superheat temperature at the outlet of the evaporator coil. The volume of refrigerant metered through the valve seat is dependent upon the following:

1. Superheat temperature is sensed by cap tube sensing bulb on suction tube at outlet of evaporator coil. This temperature is converted into pressure by refrigerant in the bulb pushing downward on the diaphragm which opens the valve via the pushrods.
2. The suction pressure at the outlet of the evaporator coil is transferred via the external equalizer tube to the underside of the diaphragm. This is needed to account for the indoor coil pressure drop. Residential coils typically have a high pressure drop, which requires this valve feature.
3. The pin is spring loaded, which exerts pressure on the underside of the diaphragm. Therefore, the bulb pressure works against the spring pressure and evaporator suction pressure to open the valve.
   If the load increases, the temperature increases at the bulb, which increases the pressure on the top side of the diaphragm. This opens the valve and increases the flow of refrigerant. The increased refrigerant flow causes the leaving evaporator temperature to decrease. This lowers the pressure on the diaphragm and closes the pin. The refrigerant flow is effectively stabilized to the load demand with negligible change in superheat.

Install TXV

The thermostatic expansion valve is specifically designed to operate with a refrigerant type. Do not use an R-22 TXV on a Puron system, and do not use a Puron valve on an R-22 system. Refer to Product Data Sheet for the appropriate TXV kit number.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Al indoor coil units must be installed with a hard shut off Puron® TXV metering device.

IMPORTANT: The TXV should be mounted as close to the indoor coil as possible and in a vertical, upright position. Avoid mounting the inlet tube vertically down. The valve is more susceptible to malfunction due to debris if inlet tube is facing down. A factory-approved filter drier must be installed in the liquid line at the indoor unit.

Installing TXV in Place of Piston in a Rated Indoor Coil (pre-2006)

1. Pump system down to 2 psig and recover refrigerant.
2. Remove hex nut from piston body. Use backup wrench on fan coils.
3. Remove and discard factory-installed piston. Be sure Teflon seal is in place.
4. Reinstall hex nut. Finger tighten nut plus 1/2 turn.

NOTE: If the piston is not removed from the body, TXV will not function properly.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Use a brazing shield and wrap TXV with wet cloth or use heat sink material

5. Install TXV on indoor coil liquid line. Sweat swivel adapter to inlet of indoor coil and attach to TXV outlet. Use backup wrench to avoid damage to tubing or valve. Sweat inlet of TXV, marked "IN" to liquid line. Avoid excessive heat which could damage valve.
6. Install vapor elbow with equalizer adapter to suction tube of line set and suction connection to indoor coil. Adapter has a 1/4-in. male connector for attaching equalizer tube.
7. Connect equalizer tube of TXV to 1/4-in. equalizer fitting on vapor line adapter.
8. Attach TXV bulb to horizontal section of suction line using clamps provided. Insulate bulb with field-supplied insulation tape. See Fig. 23 for correct positioning of sensing bulb.
9. Proceed with remainder of unit installation.

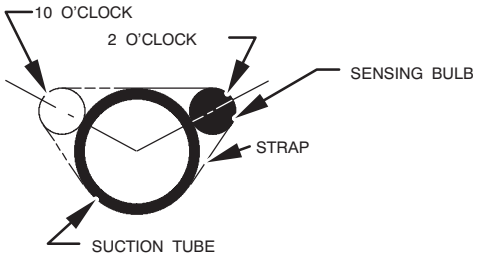

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Fig. 23 – Position of Sensing Bulb

Replacing TXV on an Indoor Coil (pre-2006)

1. Pump system down to 2 psig and recover refrigerant.
2. Remove coil access panel and fitting panel from front of cabinet.
3. Remove TXV support clamp using a 5/16-in. nut driver. Save the clamp.
4. Remove R-22 TXV using a backup wrench on flare connections to prevent damage to tubing.
5. Using wire cutters, cut equalizer tube off flush with vapor tube inside cabinet.
6. Remove bulb from vapor tube inside cabinet.
7. Braze equalizer stub-tube closed. Use protective barrier as necessary to prevent damage to drain pan.

IMPORTANT: Route the equalizer tube of TXV through suction line connection opening in fitting panel prior to replacing fitting panel around tubing.

8. Install TXV with 3/8-in. copper tubing through small hole in service panel. Use wrench and backup wrench, to avoid damage to tubing or valve, to attach TXV to distributor.
9. Reinstall TXV support clamp (removed in item 3).
10. Attach TXV bulb to vapor tube inside cabinet, in same location as original was when removed, using supplied bulb clamps (nylon or copper). See Fig. 23 for correct positioning of sensing bulb.
11. Route equalizer tube through suction connection opening (large hole) in fitting panel and install fitting panel in place.
12. Sweat inlet of TXV, marked "IN" to liquid line. Avoid excessive heat which could damage valve.
13. Install vapor elbow with equalizer adapter to vapor line of line set and vapor connection to indoor coil. Adapter has a 1/4-in. male connector for attaching equalizer tube.
14. Connect equalizer tube of TXV to 1/4-in. equalizer fitting on vapor line adapter. Use backup wrench to prevent damage to equalizer fitting.
15. Proceed with remainder of unit installation.

Replacing TXV on Indoor Coil (post-2006)

1. Pump system down to 2 psig and recover refrigerant.
2. Remove coil access panel and fitting panel from front of cabinet.
3. Remove TXV support clamp using a 5/16-in. nut driver. Save the clamp (N coils only).
4. Remove TXV using a backup wrench on connections to prevent damage to tubing.
5. Remove equalizer tube from suction line of coil.
   Note: Some coils may have a mechanical connection. If coil has a braze connection, use file or tubing cutter to cut brazed equalizer line approximately 2 inches above suction tube.
6. Remove bulb from vapor tube inside cabinet.
7. Install the new TXV using a wrench and backup wrench to avoid damage to tubing or valve to attach TXV to distributor.
8. Reinstall TXV support clamp (removed in item 3). (N coils only.)
9. Attach equalizer tube to suction line. If coil has mechanical connection, then use wrench and back up wrench to attach. If coil has brazed connection, use file or tubing cutters to remove mechanical flare nut from equalizer line. Then use coupling to braze the equalizer line to stub (previous equalizer line) in suction line.
10. Attach TXV bulb to vapor tube inside cabinet, in same location as original was when removed, using supplied bulb clamps (nylon or copper). See Fig. 23 for correct positioning of sensing bulb.
11. Route equalizer tube through suction connection opening (large hole) in fitting panel and install fitting panel in place.
12. Sweat inlet of TXV, marked "IN" to liquid line. Avoid excessive heat which could damage valve.
13. Proceed with remainder of unit installation.

MAKE PIPING CONNECTIONS

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Use all service ports and open all flow-control devices, including solenoid valves.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Do not leave system open to atmosphere any longer than minimum required for installation. POE oil in compressor is extremely susceptible to moisture absorption. Always keep ends of tubing sealed during installation.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

If ANY refrigerant tubing is buried, provide a 6 in. vertical rise at service valve. Refrigerant tubing lengths up to 36 in. may be buried without further special consideration. Do not bury lines longer than 36 in.

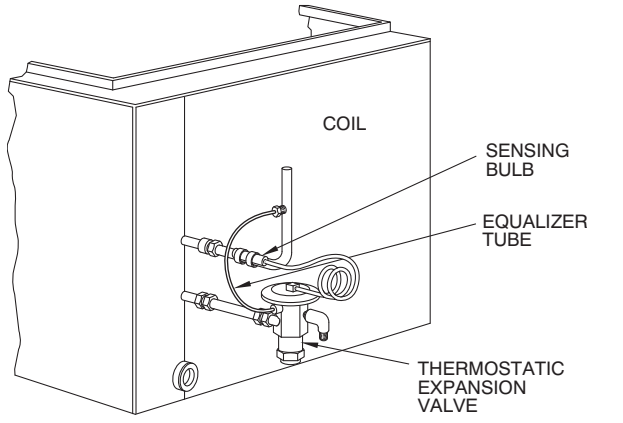

Fig. 24 – Typical TXV Installation

REFRIGERATION SYSTEM REPAIR

Leak Detection

New installations should be checked for leaks prior to complete charging. If a system has lost all or most of its charge, system must be pressurized again to approximately 150 psi minimum and 375 psi maximum. This can be done by adding refrigerant using normal charging procedures or by pressurizing system with nitrogen (less expensive than refrigerant). Nitrogen also leaks faster than refrigerants. Nitrogen cannot, however, be detected by an electronic leak detector. (See Fig. 25.)

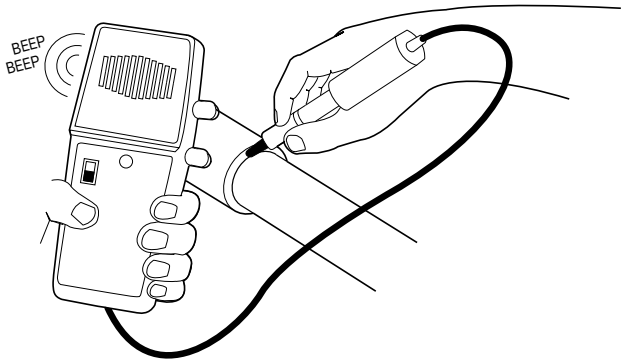

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Fig. 25 – Electronic Leak Detection

⚠ WARNING

PERSONAL INJURY AND UNIT DAMAGE HAZARD

Failure to follow this warning could result in personal injury or death.

Due to the high pressure of nitrogen, it should never be used without a pressure regulator on the tank.

Assuming that a system is pressurized with either all refrigerant or a mixture of nitrogen and refrigerant, leaks in the system can be found with an electronic leak detector that is capable of detecting specific refrigerants.

If system has been operating for some time, first check for a leak visually. Since refrigerant carries a small quantity of oil, traces of oil at any joint or connection is an indication that refrigerant is leaking at that point.

A simple and inexpensive method of testing for leaks is to use soap bubbles. (See Fig. 26.) Any solution of water and soap may be used. Soap solution is applied to all joints and connections in system. A small pinhole leak is located by tracing bubbles in soap solution around leak. If the leak is very small, several minutes may pass before a bubble will form. Popular commercial leak detection solutions give better, longer- lasting bubbles and more accurate results than plain soapy water. The bubble solution must be removed from the tubing and fittings after checking for leaks as some solutions may corrode the metal.

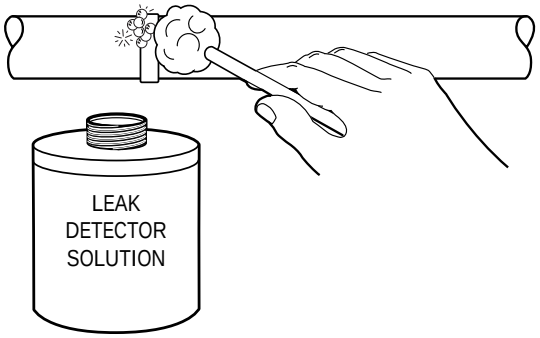

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Fig. 26 – Bubble Leak Detection

You may use an electronic leak detector designed for specific refrigerant to check for leaks. (See Fig. 25.) This unquestionably is the most efficient and easiest method for checking leaks. There are various types of electronic leak detectors. Check with manufacturer of equipment for suitability. Generally speaking, they are portable, lightweight, and consist of a box with several switches and a probe or sniffer. Detector is turned on and probe is passed around all fittings and connections in system. Leak is detected by either the movement of a pointer on detector dial, a buzzing sound, or a light.

In all instances when a leak is found, system charge must be recovered and leak repaired before final charging and operation. After leak testing or leak is repaired, replace liquid line filter drier, evacuate system, and recharge with correct refrigerant quantity.

Coil Removal

Coils are easy to remove if required for compressor removal, or to replace coil.

1. Shut off all power to unit.
2. Recover refrigerant from system through service valves.
3. Break vacuum with nitrogen.
4. Remove top cover. (See Remove Top Cover in Cabinet section of the manual.)
5. Remove screws in base pan to coil grille.
6. Remove coil grille from unit.
7. Remove screws on corner post holding coil tube sheet.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Cut tubing to reduce possibility of personal injury and fire.

8. Use midget tubing cutter to cut liquid and vapor lines at both sides of coil. Cut in convenient location for easy reassembly with copper slip couplings.
9. Lift coil vertically from basepan and carefully place aside.
10. Reverse procedure to reinstall coil.
11. Replace filter drier, evacuate system, recharge, and check for normal systems operation.

Aluminum Coil Removal

For all aluminum coils, the coil has two fin isolators on the top of the coil as shown in Fig. 27. Also, the top and bottom of the tube sheets have edge guards. These must be reinstalled after removal of the coil.

The orientation of the fin isolator is shown in Fig. 28. There is a threaded mechanical fitting on the liquid distributor. This connection is not field serviceable and should not be disturbed.

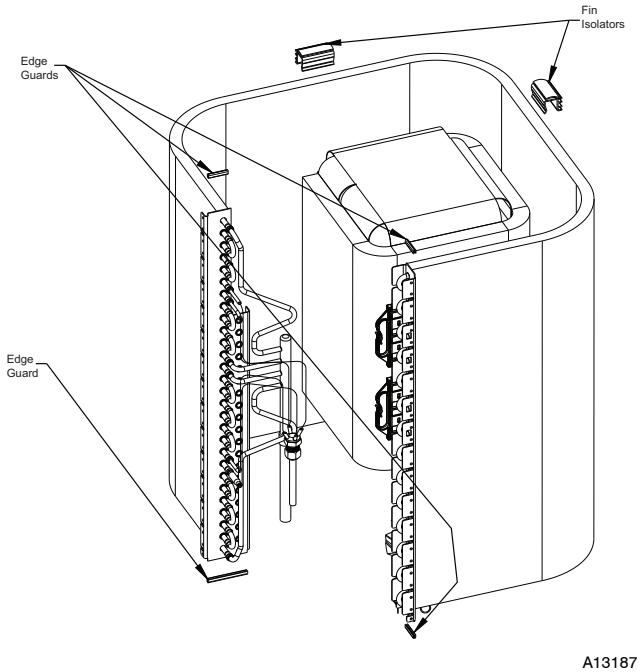

Fig. 27 – Edge Guards & Fin Isolator Location

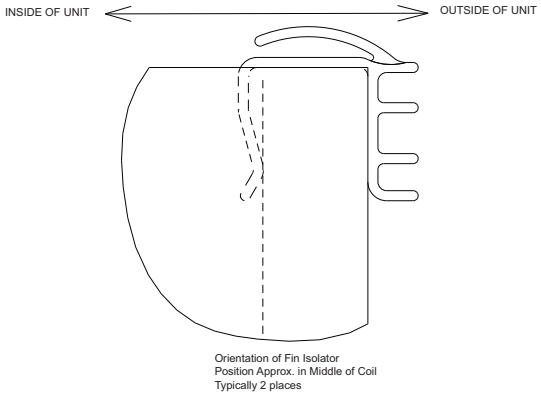

Fig. 28 – Fin Isolator Orientation

The copper stub tube connection to the liquid service valve needs to be un-brazed for coil removal. (See Fig. 29.)

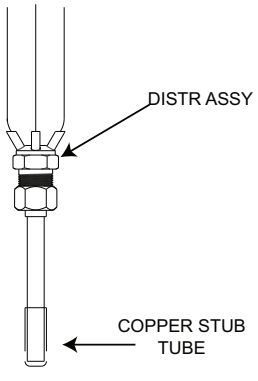

Fig. 29 – Copper Stub Tube Connection

Compressor Removal and Replacement

Once it is determined that compressor has failed and the reason established, compressor must be replaced.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Turn off all power to unit before proceeding. Wear safety glasses, protective clothing, and gloves when handling refrigerant. Acids formed as a result of motor burnout can cause burns.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant and when using brazing torch..

1. Shut off all power to unit.
2. Remove and recover all refrigerant from system until pressure gauges read 0 psi. Use all service ports. Never open a system under a vacuum to atmosphere. Break vacuum with dry nitrogen holding charge first. Do not exceed 5 psig.
3. Disconnect electrical leads from compressor. Disconnect or remove crankcase heater and remove compressor hold-down bolts.
4. Cut compressor from system with tubing cutter. Do not use brazing torch for compressor removal. Oil vapor may ignite when compressor is disconnected.
5. Scratch matching marks on stubs in old compressor. Make corresponding marks on replacement compressor.
6. Use torch to remove stubs from old compressor and to reinstall them in replacement compressor.
7. Use copper couplings to tie compressor back into system.
8. Replace filter drier, evacuate system, recharge, and check for normal system operation.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Do not leave system open to atmosphere. Compressor oil is highly susceptible to moisture absorption.

System Clean- Up After Burnout

Some compressor electrical failures can cause motor to burn. When this occurs, by- products of burn, which include sludge, carbon, and acids, contaminate system. Test the oil for acidity using POE oil acid test to determine burnout severity. If burnout is severe enough, system must be cleaned before replacement compressor is installed. The 2 types of motor burnout are classified as mild or severe.

In mild burnout, there is little or no detectable odor. Compressor oil is clear or slightly discolored. An acid test of compressor oil will be negative. This type of failure is treated the same as mechanical failure. Liquid- line strainer should be removed and liquid- line filter drier replaced.

In a severe burnout, there is a strong, pungent, rotten egg odor. Compressor oil is very dark. Evidence of burning may be present in tubing connected to compressor. An acid test of compressor oil will be positive. Follow these additional steps:

1. TXV must be cleaned or replaced.
2. Drain any trapped oil from accumulator if used.
3. Remove and discard liquid- line strainer and filter drier.
4. After system is reassembled, install liquid and suction- line Puron® filter driers.

NOTE: On heat pumps, install suction line drier between compressor and accumulator.

5. Operate system for 10 hr. Monitor pressure drop across drier. If pressure drop exceeds 3 psig replace suction- line and liquid- line filter driers. Be sure to purge system with dry nitrogen when replacing filter driers. If suction line driers must be replaced, retest pressure drop after additional 10 hours (run time). Continue to monitor pressure drop across suction line filter drier. After 10 hr of run time, remove suction- line filter drier and replace liquid- line filter drier. Never leave suction- line filter drier in system longer than 72 hr (run time).
6. Charge system. (See unit information plate.)

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Only suction line filter driers should be used for refrigerant and oil clean up. Use of non- approved products could limit system life and void unit warranty.

Evacuation

Proper evacuation of the system will remove non- condensibles and assure a tight, dry system before charging. The two methods used to evacuate a system are the deep vacuum method and the triple evacuation method.

Deep Vacuum Method

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 microns and a vacuum gauge capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and moisture. (See Fig. 30.)

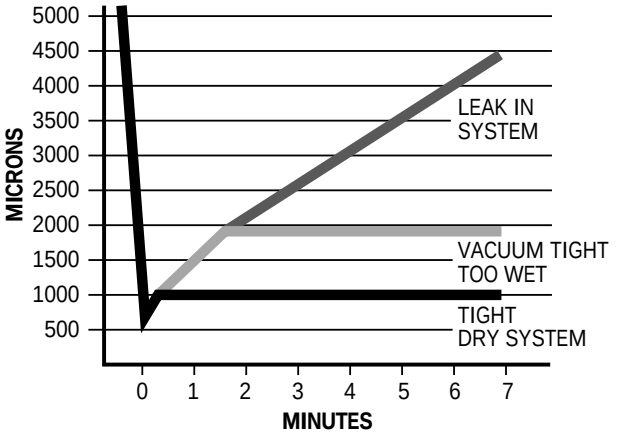

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Fig. 30 – Deep Vacuum Graph

Triple Evacuation Method

The triple evacuation method should be used when vacuum pump is only capable of pumping down to 28 in. of mercury vacuum and system does not contain any liquid water. Refer to Fig. 31 and proceed as follows:

1. Pump system down to 28 in. of mercury and allow pump to continue operating for an additional 15 minutes.
2. Close service valves and shut off vacuum pump.
3. Connect a nitrogen cylinder and regulator to system and open until system pressure is 2 psig.
4. Close service valve and allow system to stand for 1 hr. During this time, dry nitrogen will be able to diffuse throughout the system absorbing moisture.
5. Repeat this procedure as indicated in Fig. 31. System will then be free of any contaminants and water vapor.

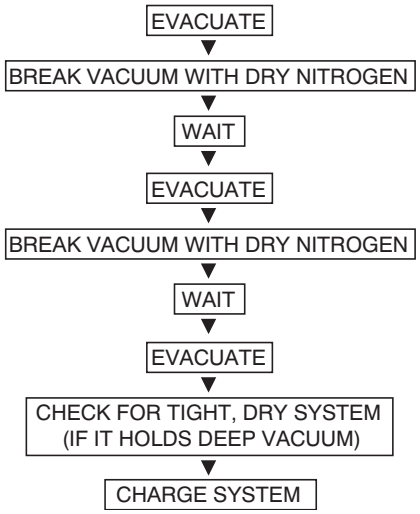

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Fig. 31 – Triple Evacuation Method

CHECK CHARGE

(See Charging Tables 10 & 12)

Factory charge amount and desired subcooling are shown on unit rating plate. Charging method is shown on information plate inside unit. To properly check or adjust charge, conditions must be favorable for subcooling charging. Favorable conditions exist when the outdoor temperature is between 70°F and 100°F (21.11°C and 37.78°C), and the indoor temperature is between 70°F and 80°F (21.11°C and 26.67°C). Follow the procedure below:

Unit is factory charged for 15ft (4.57 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft of 3/8 liquid line above or below 15ft (4.57 m) respectively.

For standard refrigerant line lengths (80 ft/24.38 m or less), allow system to operate in cooling mode at least 15 minutes. If conditions are favorable, check system charge by subcooling method. If any adjustment is necessary, adjust charge slowly and allow system to operate for 15 minutes to stabilize before declaring a properly charged system.

If the indoor temperature is above 80°F (26.67°C), and the outdoor temperature is in the favorable range, adjust system charge by weight based on line length and allow the indoor temperature to drop to 80°F (26.67°C) before attempting to check system charge by subcooling method as described above.

If the indoor temperature is below 70°F (21.11°C), or the outdoor temperature is not in the favorable range, adjust charge for line set length above or below 15ft (4.57 m) only. Charge level should then be appropriate for the system to achieve rated capacity. The charge level could then be checked at another time when the both indoor and outdoor temperatures are in a more favorable range.

NOTE: If line length is beyond 80 ft (24.38 m) or greater than 20 ft (6.10 m) vertical separation, See Long Line Guideline for special charging requirements.

TROUBLESHOOTING WITH SUPERHEAT

This troubleshooting routine was developed to diagnose cooling problems using superheat in TXV systems. It is effective on heat pumps in cooling mode as well as air conditioners. The system must utilize a TXV as the expansion device in cooling mode.

Basic Diagnostics

NOTE: When checking refrigerant charge and troubleshooting operating systems, the indoor airflow has significant effect on the determination. If you are at this stage, it is assumed you have already checked the subcooling once and believe the charge is correct. From this point, the airflow must be verified prior to proceeding, hence step 1 below.

1. Check or verify proper indoor airflow
   - Indoor air filter
   - Duct dampers and supply registers are open
   - Indoor coil for debris
2. Check subcooling at OD unit liquid service valve
   - Outdoor airflow (debris on coil, etc.)
   - Set the subcooling at value listed on rating plate if standard lineset
   - Set the subcooling at the maximum of 10°F or value listed on rating plate if a long line application
3. Check superheat at OD unit vapor service valve.
   - If low (< 2°F), proceed to Low SuperHeat section.
   - If between 2 and 20°F/11°C valve is probably operating properly.
   - If greater than 20°F/11°C, perform Pseudo Evaporator SuperHeat Instructions check as follows:
     - — Check refrigerant pressure at vapor service valve and refrigerant temperature at outlet of evaporator.
     - — Use suction line geometry (diameter and equivalent length), unit capacity and Tables 7 and 8 to determine suction pressure drop.
       - For standard lineset diameters (vapor service valve diameters and larger) and lengths (less than 80 ft), generally no pressure adjustment (per Table 5 or 6) is required.
       - For longer (greater than 80 ft) and small diameter . linesets (less than service valve size), correct pressure (add to gauge pressure reading) per Tables 5 and 6.
   - If Pseudo Superheat is greater than 15, proceed to High SuperHeat section.
   - If Pseudo Evaporator Superheat is between 2 and 15, TXV appears to be functioning properly.
   - If operation erratic (hunting), proceed to Hunting Superheat °F Superheat in repetition section.

NOTE: Hunting is when the valve superheat swings more than 10°.

Low Superheat with Normal or Low Suction Pressure

NOTE: Normal or low suction pressure is considered for R-22: < 80 psig, Puron: < 135 psig

1. Re-check airflow and then check sensing bulb tightness, orientation on vapor tube and is properly wrapped.
   - Low Superheat with Normal or Low Suction Pressure If OK proceed to Step 2
2. Check superheat at Vapor Service Valve and Pseudo Evaporator Superheat.
   - If both are less than 2°F, TXV likely not controlling properly, i.e. stuck open -> REPLACE VALVE
   - If superheat is higher than 15°F, proceed to Step 3
3. Perform TXV function check.
   - With system running, place sensing bulb in ice bath for ~1 minute -> superheat should increase.
     - — If no response, Replace Valve
     - — If OK proceed to Step 4
4. Check for even temperature distribution at outlet of each circuit of evaporator
   - If greater than 15°F between circuits, distributor or coil has a restriction.
   - If OK proceed to Step 5

Low Superheat with High Suction Pressure

NOTE: High suction pressure is considered for R-22: > ~80 psig, Puron: > ~135 psig. An application issue or other system component failure typically causes this condition.

5. R-22 Systems: Check that proper valve used (not an R-410A valve)
   - If OK proceed to Step 6
6. Check airflow, sensing bulb tightness, orientation on vapor tube and ensure bulb is properly wrapped.
   - If OK proceed to Step 7
7. Check that compressor is pumping properly

NOTE: Loose Rules of Thumb: Is discharge saturated ~20°F higher than ambient temperature? Is discharge superheat between 15 and 50?

   - If OK proceed to Step 8
8. Recheck Airflow and Subcooling.
   - If OK proceed to Replace Valve

High Superheat with Normal or Low Pressure

NOTE: Normal or low suction pressure is considered: R-22 < 80 psig, Puron < 135 psig.

9. Check for restriction in liquid line (kinked line, filter drier restricted, etc.)
   - If OK proceed to Step 10
10. Check for restriction in suction line (kink, restricted suction filter drier etc.))
    - If OK proceed to Step 11
11. Check power element cap tube is not broken
    - If OK proceed to Step 12
12. Check that equalizer tube is not kinked or plugged
    - If OK proceed to Step 13
13. Check that inlet screen (R-22 systems) is not restricted
    - If OK proceed to Step 14
14. Replace Valve

High Superheat with Normal or High Suction Pressure

NOTE: Normal to High suction pressure is considered for R-22: > ~65 psig, Puron: > ~110 psig. An application issue or other system component failure typically causes this condition.

15. Check airflow, sensing bulb tightness, orientation on vapor tube and ensure bulb is properly wrapped.
    - If OK proceed to Step 16
16. R-410A Systems: Make sure proper valve is used (Not R-22)
    - If OK proceed to Step 17
17. Check for even temperature distribution at outlet of each circuit of evaporator
    - If OK proceed to Step 18
18. Check for high evaporator load: Return Air Leaks, high indoor wet bulb and/or dry bulb temp, undersized system, etc.
    - If OK proceed to Step 19
19. Check that compressor is pumping properly
    - Loose Rule of Thumb: Is discharge saturated ~20°F higher than ambient temperature? Is discharge superheat between 15°F and 50°F?

Hunting Superheat

NOTE: Hunting is when the valve superheat swings more than 10°F Superheat in repetition. This is typically an application issue.

20. Check for obvious kinked or pinched distributor (capillary) tubes causing imbalance to the circuiting.
    - If OK proceed to Step 21
21. Check that proper size valve is used per Product Literature.
    - If OK proceed to Step 22
22. Check airflow, sensing bulb tightness, orientation on vapor tube and ensure bulb is properly wrapped.
    - If OK proceed to Step 23
23. Check for even temperature distribution (±5° difference) at outlet of each circuit of evaporator and for even air distribution over all evaporator slabs
    - If OK proceed to Step 24.
24. Move sensing bulb further down suction line.
    - If problem not corrected, replace valve

Pseudo Evaporator Superheat Instructions

The Pseudo Evaporator Superheat calculates the superheat at the outlet of the evaporator with known and available information. Because there generally is not a pressure port on the vapor line at the indoor coil, this procedure allows the service personnel to evaluate the evaporator superheat with the vapor pressure port at the outdoor unit.

The method requires the following information:

- Suction line temperature at the outlet of the evaporator (°F).
- Suction line pressure at the outdoor unit (psig).
- Outdoor nominal unit size (btuh).
- Suction line equivalent line length (ft).
- Suction line pressure drop from tables (Table 5 and Table 6).
- Pressure-Temperature relationship for refrigerant used (P-T Chart).

If system uses a vapor line the same size as vapor service valve fitting or larger AND the line set equivalent length is 80 feet or less, the pressure drop in vapor line of line set can be ignored.

1. Take suction line temperature at outlet of evaporator at indoor unit.
2. Take suction service valve pressure at OD unit.
3. Determine lineset vapor line equivalent length and tube diameter.
4. Determine suction line pressure drop from Table 5 (Puron) or Table 6 (R-22).
5. Calculate Pseudo Evaporator Superheat.
    - Add the suction line pressure drop to the pressure reading obtained at suction service valve.

NOTE: For nominal and larger diameter vapor lines with standard length linesets (vapor line same size as service valve fitting size and larger with equivalent length less than 80 ft) the pressure drop can be ignored – use vapor service valve pressure and evaporator outlet temperature to calculate superheat

- Determine saturated evaporator temperature from a refrigerant pressure temperature relationship chart (PT chart).
- Subtract saturated evaporator from evaporator suction line temperature to obtain evaporator superheat.

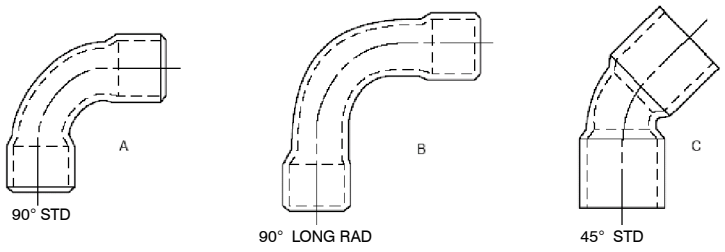

Fig. 32 – Tube Fitting Geometry

Table 4—Fitting Losses in Equivalent Feet

TUBE SIZE OD (IN.)	90° STD (A)	90° LONG RAD (B)	45° STD (C)
1/2	1.2	0.8	0.6
5/8	1.6	1.0	0.8
3/4	1.8	1.2	0.9
7/8	2.0	1.4	1.0
1- 1/8	2.6	1.7	1.3

Table 5—Puron System Suction Pressure Drop

Nominal Size (Btuh)	Suction Line OD (in.)	Pressure Drop (psi/100 ft)	Suction Velocity fpm	Puron Suction Line Pressure Drop (psig) Total Equivalent Line Length (ft)									
				20	50	80	100	125	150	175	200	225	250
18000	1/2	9.9	1649	2	5	8	10	12	15	17	20	22	25
	5/8	3.1	1018	1	2	2	3	4	5	5	6	7	8
	3/4	1.2	678	0	1	1	1	1	2	2	2	3	3
24000	1/2	16.7	2199	3	8	13	17	21	25	29	33	38	42
	5/8	5.2	1357	1	3	4	5	7	8	9	10	12	13
	3/4	2.0	904	0	1	2	2	2	3	3	4	4	5
	7/8	1.0	678	0	0	1	1	1	1	2	2	2	2
30000	5/8	7.8	1696	2	4	6	8	10	12	14	16	18	20
	3/4	2.9	1130	1	1	2	3	4	4	5	6	7	7
	7/8	1.5	848	0	1	1	1	2	2	3	3	3	4
36000	5/8	10.9	2036	2	5	9	11	14	16	19	22	24	27
	3/4	4.1	1356	1	2	3	4	5	6	7	8	9	10
	7/8	2.0	1017	0	1	2	2	3	3	4	4	5	5
42000	5/8	14.1	2375	3	7	11	14	18	21	25	28	32	35
	3/4	5.4	1582	1	3	4	5	7	8	9	11	12	14
	7/8	2.7	1187	1	1	2	3	3	4	5	5	6	7
	1 1/8	0.8	696	0	0	1	1	1	1	1	2	2	2
48000	3/4	6.9	1808	1	3	6	7	9	10	12	14	16	17
	7/8	3.5	1357	1	2	3	3	4	5	6	7	8	9
	1 1/8	1.0	796	0	0	1	1	1	1	2	2	2	2
60000	3/4	10.4	2260	2	5	8	10	13	16	18	21	23	26
	7/8	5.2	1696	1	3	4	5	6	8	9	10	12	13
	1 1/8	1.4	995	0	1	1	1	2	2	3	3	3	4

Line set application not recommended

Example 1

While on a service call, after checking for proper indoor and outdoor airflow, Tom finds the following pressures and temperatures at the service valves of a Puron air conditioner:

- Liquid line pressure = 340 psig
- Liquid line temperature = 97°F
- Suction line pressure = 125 psig
- Suction line temperature = 70°F

Using a Puron PT chart, the subcooling is determined to be 8°F, which is within ±3 of the 10°F listed on the rating plate. Tom believes the charge is correct. He calculates the superheat to be approximately 27°F superheat. The apparently high superheat has Tom concerned.

Tom uses the Pseudo Evaporator Superheat method to check the TXV performance. The system is a 3-ton Puron air conditioner with 75 feet equivalent length of 3/4" suction line. Based on Table 5, the system has approximately 3-psig pressure drop in the vapor line. Per the instructions, he takes the suction line temperature at the outlet of the evaporator and finds it to be 53°F. Tom adds 3 psig to the 125-psig suction pressure at the outdoor unit to get 128 psig evaporator pressure. The saturated pressure of 128 equates to 44°F. Tom calculates the evaporator superheat to be (53°F - 44°F =) 9°F. The TXV appears to be operating properly.

NOTE: The additional superheat at the compressor is due principally to heat gain in the 75 feet of suction line with a minor contribution by the pressure drop. Because the suction line of the lineset was the same size as the vapor service valve fitting and less than 80 feet, Tom could have ignored the pressure drop in the suction line and obtained the evaporator superheat by using the vapor service valve pressure of 125 psig (saturated temperature = 43°F) and the evaporator outlet temperature of 53°F. The evaporator superheat is calculated to be (53°F – 43°F =) 10 °F.

Table 6—R-22 System Suction Pressure Drop

Nominal Size (Btuh)	Line OD (in.)	Pressure Drop (psi/100 ft)	Suction Velocity Fpm	R-22 Suction Line Pressure Drop (psig) Total Equivalent Line Length (ft)									
				20	50	80	100	125	150	175	200	225	250
18000	5/8	13.6	2563	3	7	11	14	17	20	24	27	31	34
	5/8	4.0	1539	1	2	3	4	5	6	7	8	9	10
	3/4	1.5	1025	0	1	1	1	2	2	3	3	3	4
	7/8	0.8	769	0	0	1	1	1	1	1	2	2	2
24000	5/8	6.7	2052	1	3	5	7	8	10	12	13	15	17
	3/4	2.5	1367	1	1	2	3	3	4	4	5	6	6
	7/8	1.3	1026	0	1	1	1	2	2	2	3	3	3
30000	5/8	10.1	2565	2	5	8	10	13	15	18	20	23	25
	3/4	3.8	1708	1	2	3	4	5	6	7	8	9	9
	7/8	1.9	1282	0	1	2	2	2	3	3	4	4	5
36000	3/4	5.3	2050	1	3	4	5	7	8	9	11	12	13
	7/8	2.6	1538	1	1	2	3	3	4	5	5	6	7
	1 1/8	0.7	902	0	0	1	1	1	1	1	1	2	2
42000	3/4	7.0	2392	1	3	6	7	9	10	12	14	16	17
	7/8	3.5	1795	1	2	3	3	4	5	6	7	8	9
	1 1/8	1.0	1053	0	0	1	1	1	1	2	2	2	2
48000	3/4	8.9	2733	2	4	7	9	11	13	16	18	20	22
	7/8	4.4	2051	1	2	4	4	6	7	8	9	10	11
	1 1/8	1.2	1203	0	1	1	1	2	2	2	2	3	3
60000	7/8	6.7	2564	1	3	5	7	8	10	12	13	15	17
	1 1/8	1.8	1504	0	1	1	2	2	3	3	4	4	5
	1 3/8	0.7	987	0	0	1	1	1	1	1	1	2	2

Line set application not recommended

Example 2

Jason is servicing a 5-ton R-22 air conditioner with 7/8" suction line. As part of his basic inspection he believes he has normal airflow because the air filters are clean, ductwork appears to be properly sized and in good shape and the evaporator coil is clean. He then checks the superheat and subcooling at the outdoor unit service valves. Taking pressures and temperatures he finds the following:

- Liquid line pressure = 260 psig
- Liquid line temperature = 110°F
- Suction line pressure = 60 psig
- Suction line temperature = 65°F

Using an R-22 PT relationship, Jason calculates the subcooling to be approximately 10°F with 30°F superheat. Because the subcooling is correct but the superheat appears to be high, he is concerned and decides to perform the Pseudo Evaporator Superheat check.

Examining the lineset, Jason finds approximately 145 ft of suction line with 4 long radius elbows. Per Fig. 33 and Table 6, each fitting has an equivalent length of 1.4 ft. The total equivalent length of the suction line is (145' + (4 * 1.4') ≈) 150 ft. Based on Table 8, Jason determines there should be 10-psig pressure-drop in the suction line.

Jason now takes the suction line temperature at the outlet of the evaporator and obtains 51°F. Per the instructions, Jason adds the 10-psig pressure-drop to the 60-psig pressure at the outdoor unit to get 70-psig at the evaporator. Saturated pressure of 70-psig equates to approximately 41°F. Jason determines the Evaporator superheat to be (51°F - 41°F =) 10°F. Jason concludes the TXV is functioning properly.

NOTE: In this situation, both the pressure drop and the heat gain in the suction line are significant contributions to the superheat at the service valve. The pressure drop contributes approximately 7°F superheat and the heat gain in the suction line contributes 13°F.

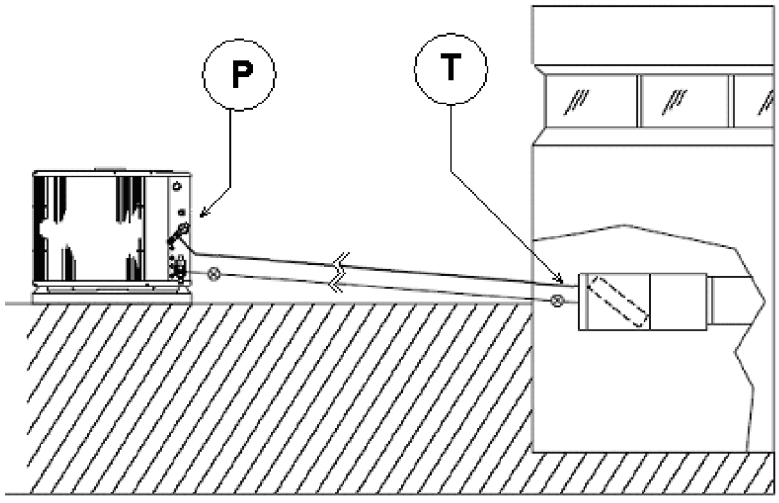

Fig. 33 – Pseudo Evaporator Superheat Pressure and Temperature Measurement Locations

Table 7—Puron® Refrigerant Pressure Temperature Chart

PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
12	-38.2	118	39.9	224	76.9	330	102.9	436	123.3	542	140.2
14	-35.3	120	40.8	226	77.4	332	103.3	438	123.6	544	140.5
16	-32.5	122	41.6	228	78.0	334	103.7	440	124.0	546	140.8
18	-29.9	124	42.5	230	78.5	336	104.1	442	124.3	548	141.1
20	-27.3	126	43.3	232	79.1	338	104.6	444	124.7	550	141.4
22	-24.9	128	44.2	234	79.7	340	105.0	446	125.0	554	141.9
24	-22.6	130	45.0	236	80.2	342	105.4	448	125.3	558	142.5
26	-20.4	132	45.8	238	80.7	344	105.8	450	125.7	560	142.8
28	-18.3	134	46.6	240	81.3	346	106.2	452	126.0	564	143.4
30	-16.2	136	47.5	242	81.8	348	106.6	454	126.4	568	143.9
32	-14.2	138	48.2	244	82.4	350	107.0	456	126.7	570	144.2
34	-12.3	140	49.0	246	82.9	352	107.5	458	127.0	574	144.8
36	-10.4	142	49.8	248	83.4	354	107.9	460	127.4	578	145.3
38	-8.6	144	50.6	250	83.9	356	108.3	462	127.7	580	145.6
40	-6.9	146	51.4	252	84.5	358	108.7	464	128.0	584	146.2
42	-5.1	148	52.1	254	85.0	360	109.1	466	128.4	588	146.7
44	-3.5	150	52.9	256	85.5	362	109.5	468	128.7	590	147.0
46	-1.9	152	53.6	258	86.0	364	109.9	470	129.0	594	147.5
48	-0.3	154	54.4	260	86.5	366	110.3	472	129.4	598	148.1
50	1.3	156	55.1	262	87.0	368	110.7	474	129.7	600	148.4
52	2.8	158	55.8	264	87.5	370	111.1	476	130.0	604	148.9
54	4.2	160	56.5	266	88.0	372	111.5	478	130.3	606	149.2
56	5.7	162	57.3	268	88.5	374	111.9	480	130.7	608	149.4
58	7.1	164	58.0	270	89.0	376	112.2	482	131.0	610	151.3
60	8.5	166	58.7	272	89.5	378	112.6	484	131.3	612	150.0
62	9.8	168	59.4	274	90.0	380	113.0	486	131.6	614	150.2
64	11.1	170	60.1	276	90.5	382	113.4	488	131.9	616	150.5
66	12.4	172	60.7	278	91.0	384	113.8	490	132.3	618	150.7
68	13.7	174	61.4	280	91.5	386	114.2	492	132.6	620	151.0
70	15.0	176	62.1	282	92.0	388	114.6	494	132.9	624	151.5
72	16.2	178	62.8	284	92.4	390	114.9	496	133.2	626	151.8
74	17.4	180	63.4	286	92.9	392	115.3	498	133.5	628	152.1
76	18.6	182	64.1	288	93.4	394	115.7	500	133.8	630	152.3
78	19.8	184	64.7	290	93.9	396	116.1	502	134.1	634	152.8
80	20.9	186	65.4	292	94.3	398	116.4	504	134.5	636	153.1
82	22.0	188	66.0	294	94.8	400	116.8	506	134.8	638	153.3
84	23.2	190	66.7	296	95.3	402	117.2	508	135.1	640	153.6
86	24.3	192	67.3	298	95.7	404	117.5	510	135.4	644	154.1
88	25.3	194	67.9	300	96.2	406	117.9	512	135.7	646	154.3
90	26.4	196	68.6	302	96.7	408	118.3	514	136.0	648	154.6
92	27.4	198	69.2	304	97.1	410	118.6	516	136.3	650	154.8
94	28.5	200	69.8	306	97.6	412	119.0	518	136.6	654	161.8
96	29.5	202	70.4	308	98.0	414	119.4	520	136.9	656	155.6
98	30.5	204	71.0	310	98.5	416	119.7	522	137.2	658	155.8
100	31.5	206	71.6	312	98.9	418	120.1	524	137.5	660	158.3
102	32.5	208	72.2	314	99.4	420	120.5	526	137.8	664	156.6
104	33.4	210	72.8	316	99.8	422	120.8	528	138.1	666	156.8
106	34.4	212	73.4	318	100.2	424	121.2	530	138.4	668	157.1
108	35.3	214	74.0	320	100.7	426	121.5	532	138.7	670	157.3
110	36.3	216	74.6	322	101.1	428	121.9	534	139.0	674	157.7
112	37.2	218	75.1	324	101.6	430	122.2	536	139.3	676	158.0
114	38.1	220	75.7	326	102.0	432	122.6	538	139.6	Critical Point	
116	39.0	222	76.3	328	102.4	434	122.9	540	139.9	705	163.0

Source: Allied Signal - Genetron for Windows version R1.0 © 1999

Table 8—R-22 Refrigerant Pressure Temperature Relationship

psig	°F	psig	°F	psig	°F	psig	°F	psig	°F	psig	°F	psig	°F
7	-25.9	71	41.7	135	76.2	199	101.1	263	120.9	327	137.5	391	152.0
8	-24.0	72	42.3	136	76.7	200	101.4	264	121.1	328	137.8	392	152.2
9	-22.1	73	43.0	137	77.1	201	101.7	265	121.4	329	138.0	393	152.4
10	-20.4	74	43.7	138	77.6	202	102.1	266	121.7	330	138.2	394	152.6
11	-18.7	75	44.3	139	78.0	203	102.4	267	122.0	331	138.5	395	152.8
12	-17.0	76	45.0	140	78.4	204	102.8	268	122.3	332	138.7	396	153.1
13	-15.4	77	45.6	141	78.9	205	103.1	269	122.5	333	139.0	397	153.3
14	-13.8	78	46.2	142	79.3	206	103.4	270	122.8	334	139.2	398	153.5
15	-12.3	79	46.9	143	79.7	207	103.8	271	123.1	335	139.4	399	153.7
16	-10.8	80	47.5	144	80.2	208	104.1	272	123.4	336	139.7	400	153.9
17	-9.3	81	48.1	145	80.6	209	104.4	273	123.6	337	139.9	401	154.1
18	-7.9	82	48.7	146	81.0	210	104.8	274	123.9	338	140.2	402	154.3
19	-6.5	83	49.4	147	81.4	211	105.1	275	124.2	339	140.4	403	154.5
20	-5.2	84	50.0	148	81.8	212	105.4	276	124.5	340	140.6	404	154.7
21	-3.9	85	50.6	149	82.3	213	105.7	277	124.7	341	140.9	405	154.9
22	-2.6	86	51.2	150	82.7	214	106.1	278	125.0	342	141.1	406	155.1
23	-1.3	87	51.8	151	83.1	215	106.4	279	125.3	343	141.3	407	155.3
24	0.0	88	52.4	152	83.5	216	106.7	280	125.5	344	141.6	408	155.6
25	1.2	89	52.9	153	83.9	217	107.0	281	125.8	345	141.8	409	155.8
26	2.4	90	53.5	154	84.3	218	107.4	282	126.1	346	142.0	410	156.0
27	3.6	91	54.1	155	84.7	219	107.7	283	126.4	347	142.3	411	156.2
28	4.7	92	54.7	156	85.1	220	108.0	284	126.6	348	142.5	412	156.4
29	5.8	93	55.2	157	85.5	221	108.3	285	126.9	349	142.7	413	156.6
30	6.9	94	55.8	158	85.9	222	108.6	286	127.2	350	142.9	414	156.8
31	8.0	95	56.4	159	86.3	223	108.9	287	127.4	351	143.2	415	157.0
32	9.1	96	56.9	160	86.7	224	109.3	288	127.7	352	143.4	416	157.2
33	10.2	97	57.5	161	87.1	225	109.6	289	127.9	353	143.6	417	157.4
34	11.2	98	58.0	162	87.5	226	109.9	290	128.2	354	143.9	418	157.6
35	12.2	99	58.6	163	87.9	227	110.2	291	128.5	355	144.1	419	157.8
36	13.2	100	59.1	164	88.3	228	110.5	292	128.7	356	144.3	420	158.0
37	14.2	101	59.7	165	88.7	229	110.8	293	129.0	357	144.5	421	158.2
38	15.2	102	60.2	166	89.1	230	111.1	294	129.3	358	144.8	422	158.4
39	16.2	103	60.7	167	89.5	231	111.4	295	129.5	359	145.0	423	158.6
40	17.1	104	61.3	168	89.9	232	111.8	296	129.8	360	145.2	424	158.8
41	18.1	105	61.8	169	90.2	233	112.1	297	130.0	361	145.4	425	159.0
42	19.0	106	62.3	170	90.6	234	112.4	298	130.3	362	145.7	426	159.2
43	19.9	107	62.8	171	91.0	235	112.7	299	130.6	363	145.9	427	159.4
44	20.8	108	63.3	172	91.4	236	113.0	300	130.8	364	146.1	428	159.6
45	21.7	109	63.9	173	91.8	237	113.3	301	131.1	365	146.3	429	159.8
46	22.6	110	64.4	174	92.1	238	113.6	302	131.3	366	146.6	430	160.0
47	23.5	111	64.9	175	92.5	239	113.9	303	131.6	367	146.8	431	160.2
48	24.3	112	65.4	176	92.9	240	114.2	304	131.8	368	147.0	432	160.4
49	25.2	113	65.9	177	93.2	241	114.5	305	132.1	369	147.2	433	160.6
50	26.0	114	66.4	178	93.6	242	114.8	306	132.3	370	147.5	434	160.8
51	26.8	115	66.9	179	94.0	243	115.1	307	132.6	371	147.7	435	161.0
52	27.6	116	67.4	180	94.3	244	115.4	308	132.8	372	147.9	436	161.2
53	28.4	117	67.9	181	94.7	245	115.7	309	133.1	373	148.1	437	161.4
54	29.2	118	68.4	182	95.1	246	116.0	310	133.3	374	148.3	438	161.6
55	30.0	119	68.8	183	95.4	247	116.3	311	133.6	375	148.6	439	161.8
56	30.8	120	69.3	184	95.8	248	116.6	312	133.8	376	148.8	440	162.0
57	31.6	121	69.8	185	96.2	249	116.8	313	134.1	377	149.0	441	162.2
58	32.4	122	70.3	186	96.5	250	117.1	314	134.3	378	149.2	442	162.3
59	33.1	123	70.7	187	96.9	251	117.4	315	134.6	379	149.4	443	162.5
60	33.9	124	71.2	188	97.2	252	117.7	316	134.8	380	149.6	444	162.7
61	34.6	125	71.7	189	97.6	253	118.0	317	135.1	381	149.9	445	162.9
62	35.4	126	72.2	190	97.9	254	118.3	318	135.3	382	150.1	446	163.1
63	36.1	127	72.6	191	98.3	255	118.6	319	135.6	383	150.3	447	163.3
64	36.8	128	73.1	192	98.6	256	118.9	320	135.8	384	150.5	448	163.5
65	37.5	129	73.5	193	99.0	257	119.2	321	136.1	385	150.7	449	163.7
66	38.2	130	74.0	194	99.3	258	119.4	322	136.3	386	150.9	450	163.9
67	38.9	131	74.5	195	99.7	259	119.7	323	136.6	387	151.1		
68	39.6	132	74.9	196	100.0	260	120.0	324	136.8	388	151.4	**Critical**	
69	40.3	133	75.4	197	100.4	261	120.3	325	137.0	389	151.6	709	205.1
70	41.0	134	75.8	198	100.7	262	120.6	326	137.3	390	151.8		

Table 9—Puron Subcooling Chart

Liquid Line Temperature (°F)											
Liq Press (psig)	P- T (°F)	Subcooling (°F)									
		2	4	6	8	10	12	14	16	18	20
200	70	68	66	64	62	60	58	56	54	52	50
210	73	71	69	67	65	63	61	59	57	55	53
220	76	74	72	70	68	66	64	62	60	58	56
230	79	77	75	73	71	69	67	65	63	61	59
240	82	80	78	76	74	72	70	68	66	64	62
250	84	82	80	78	76	74	72	70	68	66	64
260	87	85	83	81	79	77	75	73	71	69	67
270	89	87	85	83	81	79	77	75	73	71	69
280	92	90	88	86	84	82	80	78	76	74	72
290	94	92	90	88	86	84	82	80	78	76	74
300	96	94	92	90	88	86	84	82	80	78	76
310	99	97	95	93	91	89	87	85	83	81	79
320	101	99	97	95	93	91	89	87	85	83	81
330	103	101	99	97	95	93	91	89	87	85	83
340	105	103	101	99	97	95	93	91	89	87	85
350	107	105	103	101	99	97	95	93	91	89	87
360	109	107	105	103	101	99	97	95	93	91	89
370	111	109	107	105	103	101	99	97	95	93	91
380	113	111	109	107	105	103	101	99	97	95	93
390	115	113	111	109	107	105	103	101	99	97	95
400	117	115	113	111	109	107	105	103	101	99	97
410	119	117	115	113	111	109	107	105	103	101	99
420	121	119	117	115	113	111	109	107	105	103	101
430	122	120	118	116	114	112	110	108	106	104	102
440	124	122	120	118	116	114	112	110	108	106	104
450	126	124	122	120	118	116	114	112	110	108	106
460	127	125	123	121	119	117	115	113	111	109	107
470	129	127	125	123	121	119	117	115	113	111	109
480	131	129	127	125	123	121	119	117	115	113	111
490	132	130	128	126	124	122	120	118	116	114	112
500	134	132	130	128	126	124	122	120	118	116	114
510	135	133	131	129	127	125	123	121	119	117	115
520	137	135	133	131	129	127	125	123	121	119	117
530	139	137	135	133	131	129	127	125	123	121	119
540	140	138	136	134	132	130	128	126	124	122	120
550	141	139	137	135	133	131	129	127	125	123	121
560	143	141	139	137	135	133	131	129	127	125	123
570	144	142	140	138	136	134	132	130	128	126	124
580	146	144	142	140	138	136	134	132	130	128	126
590	147	145	143	141	139	137	135	133	131	129	127
600	149	147	145	143	141	139	137	135	133	131	129
610	150	148	146	144	142	140	138	136	134	132	130

Table 10—Puron Superheat Chart

Vapor Line Temperature (°F)																
Vap Press (psig)	P-T (°F)	Superheat (°F)														
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
80	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51
82	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52
84	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53
86	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54
88	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55
90	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56
92	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57
94	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59
96	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
98	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61
100	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62
102	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63
104	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64
106	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
108	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
110	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66
112	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
114	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68
116	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69
118	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
120	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71
122	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72
124	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73
126	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
128	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
130	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75
132	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
134	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77
136	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
138	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
140	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79
142	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
144	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81
146	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82
148	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82
150	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83
152	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
154	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85
156	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85
158	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86
160	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87
162	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88

Table 11—R- 22 Subcooling Chart

R- 22 Liquid Line Temperature (°F)														
Liquid Pres (psig)	PT (°F)	Subcooling (°F)												
		2	4	6	8	10	12	14	16	18	20	22	24	26
120	70	68	66	64	62	60	58	56	54	52	50	48	46	44
125	72	70	68	66	64	62	60	58	56	54	52	50	48	46
130	74	72	70	68	66	64	62	60	58	56	54	52	50	48
135	76	74	72	70	68	66	64	62	60	58	56	54	52	50
140	79	77	75	73	71	69	67	65	63	61	59	57	55	53
145	81	79	77	75	73	71	69	67	65	63	61	59	57	55
150	83	81	79	77	75	73	71	69	67	65	63	61	59	57
155	85	83	81	79	77	75	73	71	69	67	65	63	61	59
160	87	85	83	81	79	77	75	73	71	69	67	65	63	61
165	89	87	85	83	81	79	77	75	73	71	69	67	65	63
170	91	89	87	85	83	81	79	77	75	73	71	69	67	65
175	93	91	89	87	85	83	81	79	77	75	73	71	69	67
180	95	93	91	89	87	85	83	81	79	77	75	73	71	69
185	96	94	92	90	88	86	84	82	80	78	76	74	72	70
190	98	96	94	92	90	88	86	84	82	80	78	76	74	72
195	100	98	96	94	92	90	88	86	84	82	80	78	76	74
200	102	100	98	96	94	92	90	88	86	84	82	80	78	76
205	103	101	99	97	95	93	91	89	87	85	83	81	79	77
210	105	103	101	99	97	95	93	91	89	87	85	83	81	79
215	107	105	103	101	99	97	95	93	91	89	87	85	83	81
220	108	106	104	102	100	98	96	94	92	90	88	86	84	82
225	110	108	106	104	102	100	98	96	94	92	90	88	86	84
230	111	109	107	105	103	101	99	97	95	93	91	89	87	85
235	113	111	109	107	105	103	101	99	97	95	93	91	89	87
240	114	112	110	108	106	104	102	100	98	96	94	92	90	88
245	116	114	112	110	108	106	104	102	100	98	96	94	92	90
250	117	115	113	111	109	107	105	103	101	99	97	95	93	91
255	119	117	115	113	111	109	107	105	103	101	99	97	95	93
260	120	118	116	114	112	110	108	106	104	102	100	98	96	94
265	121	119	117	115	113	111	109	107	105	103	101	99	97	95
270	123	121	119	117	115	113	111	109	107	105	103	101	99	97
275	124	122	120	118	116	114	112	110	108	106	104	102	100	98
280	126	124	122	120	118	116	114	112	110	108	106	104	102	100
285	127	125	123	121	119	117	115	113	111	109	107	105	103	101
290	128	126	124	122	120	118	116	114	112	110	108	106	104	102
295	129	127	125	123	121	119	117	115	113	111	109	107	105	103
300	131	129	127	125	123	121	119	117	115	113	111	109	107	105
305	132	130	128	126	124	122	120	118	116	114	112	110	108	106
310	133	131	129	127	125	123	121	119	117	115	113	111	109	107
315	135	133	131	129	127	125	123	121	119	117	115	113	111	109
320	136	134	132	130	128	126	124	122	120	118	116	114	112	110
325	137	135	133	131	129	127	125	123	121	119	117	115	113	111
330	138	136	134	132	130	128	126	124	122	120	118	116	114	112

Table 12—R- 22 Superheat Chart

R- 22 Vapor Line Temperature (°F)																
Vapor Press (psig)	PT (°F)	Superheat (°F)														
		2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
50	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56
51	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57
52	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58
53	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58
54	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59
55	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
56	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61
57	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62
58	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62
59	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63
60	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64
61	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
62	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65
63	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66
64	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67
65	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68
66	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68
67	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69
68	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
69	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
70	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71
71	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72
72	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72
73	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73
74	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
75	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
76	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75
77	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
78	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
79	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77
80	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
81	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78
82	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79
83	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
84	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
85	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81
86	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81
87	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82
88	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83
89	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83
90	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
91	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
92	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85

TWO-STAGE 25HNB/24ANB

Application Guidelines

Carrier designed and tested the two-stage air conditioner and heat pump products with Puron refrigerant to operate at a minimum outdoor operating ambient in cooling mode at 55°F without low ambient cooling enabled and the maximum outdoor operating ambient in cooling is 125°F/51.6°C. On Infinity communicating systems, only low ambient cooling is available to 0°F/-17.8°C.

The maximum outdoor operating ambient in heating mode is 66°F/18.8°C on all heat pumps. Continuous operation in heating mode is approved to -30°F/-34.4°C. Thermostat options for the two stage units are as follows:

- A,B,C,D four-wire connections for Infinity User Interface.
- R,C,W,Y1,Y2, and O wire connections for standard, non-communicating thermostat.

25HNB6, 25HNB9, 24ANB7, and 24ANB1 units can run, and are matched with, User Interface (UI) communicating and non-communicating indoor fan coils and furnaces. Only unit combinations listed in the two-stage Product Data are recommended.

Line sets for two stage units are similar to the single stage units. However, some restrictions may apply to specific combinations in long line applications. Refer to the *Long Line Guideline* for further information.

The Tennessee Valley Authority (TVA) requires that electric strip heat have a lockout feature. This is achieved through Carrier thermostats required per above and must be used on all TVA approved units.

The new control board in the two stage units with Puron refrigerant has dip switches for defrost timing. The Infinity controls provide these two stage units with high stage latching and Hybrid Heat™ (dual fuel) capabilities. The standard Hybrid Heat™ (duel fuel) thermostat can be used on two stage units with Bristol reciprocating compressors only.

Model Plug

Each control board contains a model plug. The correct model plug must be installed in order for the system to operate properly. (See Table 13.)

The model plug is used to identify the type and size of unit to the control. On 25HNB6 models, the model plug is also used to determine the start sequence timing for each individual model.

On new units, the model and serial numbers are inputted into the board's memory at the factory. If a model plug is lost or missing at initial installation, the unit will operate according to the information input at the factory and the appropriate error code will flash temporarily. An RCD replacement board contains no model and serial information. If the factory control board fails, the model plug must be transferred from the original board to the replacement board for the unit to operate.

NOTE: The model plug takes priority over factory model information input at the factory. If the model plug is removed after initial power up, the unit will operate according to the last valid model plug installed, and flash the appropriate fault code temporarily.

Table 13—Model Plug Information

MODEL NUMBER	MODEL PLUG NUMBER	PIN RESISTANCE (K- ohms)	
		Pins 1- 4	Pins 2- 3
25HNB624	HK70EZ041	18	91
25HNB636	HK70EZ043	18	150
25HNB648	HK70EZ045	18	220
25HNB660	HK70EZ047	18	360
25HNB924	HK70EZ010	5.1	120
25HNB936	HK70EZ012	5.1	180
25HNB948	HK70EZ014	5.1	270
25HNB960	HK70EZ016	11	5.1
24ANB124	HK70EZ009	5.1	91
24ANB136	HK70EZ011	5.1	150
24ANB148	HK70EZ013	5.1	220
24ANB160	HK70EZ015	5.1	360
24ANB724	HK70EZ040	18	75
24ANB736	HK70EZ042	18	120
24ANB748	HK70EZ044	18	180
24ANB760	HK70EZ046	18	270

Airflow Selections for 24ANB7 / 25HNB6 / 24ANB1 /25HNB9 Using Non-Communicating (Non-Infinity) Thermostats

Airflow Selection for 58CVA/58MVB Furnaces

The 58CVA/58MVB variable-speed furnaces provide high- and low-stage blower operation to match the capacities of the compressor at high and low stages. To select the recommended airflow and for adjustments to the manual switches labeled SW1-5, AC, and CF on the control board, refer to the furnace Installation Instructions. The 58CVA/58MVB utilizes a control center that allows the installing technician to select the proper airflows. The HP switch determines the airflow during high-stage compressor operation. Airflow for high- and low-stage can be calculated at either 350 CFM per ton or 400 CFM per ton, based on the positions of SW1-5.

When using communicating (Infinity) control, dipswitch adjustments are not necessary on furnaces. Airflows are determined by Infinity Control setup.

Airflow Selection for FV4 Fan Coils for 24ANB1, 24ANB7, 25HNB6, 25HNB9 Using Non-Communicating (Non-Infinity) Thermostats

The FV4 provides high- and low-stage blower operation to match the capacities of compressor at high- and low-stage. To select recommended airflow, refer to FV4 Installation Instructions. The FV4 utilizes an Easy Select control board that allows the installing technician to select proper airflows. For adjustments to control board, select appropriate HP SIZE and CFM ADJUST setting. This fan coil has an adjustable blower off delay factory set at 90 sec for high- and low-stage blower operation.

For other combinations of equipment consult Product Data Digest.

GENERAL INFORMATION

Low Ambient Cooling

When this unit is operating below 55°F outdoor temperature, provisions must be made for low ambient operation.

Infinity Controlled low ambient cooling:

This unit is capable of low ambient cooling without a kit ONLY when using Infinity control. A low ambient kit is not required, and the outdoor fan motor does not need to be replaced for Infinity controlled low ambient operation. The Infinity Control provides an automatic evaporator coil freeze protection algorithm that eliminates the need for an evaporator freeze thermostat. Low ambient cooling must be enabled in the User Interface set up. Fan may not begin to cycle until about 40°F OAT. Fan will cycle based on coil and outdoor air temperature.

Infinity controlled low ambient mode operates as follows:

- Fan is OFF when outdoor coil temp is < (outdoor air temperature + 3°F) or outdoor fan has been ON for 30 minutes. (Fan is turned off to allow refrigerant system to stabilize.)
- Fan is ON when outdoor coil temp > (outdoor air temperature + 25°F) or outdoor coil temp > 80°F or if outdoor fan has been OFF for 30 minutes. (Fan is turned on to allow refrigerant system to stabilize.)
- Low pressure switch is ignored for first 3 minutes during low ambient start up. After 3 minutes, if LPS trips, then outdoor fan motor is turned off for 10 minutes, with the compressor running. If LPS closes within 10 minutes then cooling continues with the outdoor fan cycling per the coil temperature routine listed above for the remainder of the cooling cycle. If the LPS does not close within 10 minutes, then the normal LPS trip response (shut down cooling operation and generate LPS trip error) will occur.

For 24ANB1/25HNB9 models, the PWM output for both high and low stage equals the value for low stage operation below 55°F.

Defrost

This control offers 5 possible defrost interval times: 30, 60, 90, 120 minutes, or AUTO.

With non-communicating thermostats, these are selected by dip switches on the unit control board. With communicating thermostats, the Infinity Control User Interface. The Infinity Control selection overrides the control board dip switch settings.

AUTO defrost adjusts the defrost interval time based on the last defrost time as follows:

- When defrost time <3 minutes, the next defrost interval=120 minutes.
- When defrost time 3-5 minutes, the next defrost interval=90 minutes.
- When defrost time 5-7 minutes, the next defrost interval=60 minutes.
- When defrost time >7 minutes, the next defrost interval=30 minutes.

The control board accumulates compressor run time. As the accumulated run time approaches the selected defrost interval time, the control board monitors the coil temperature sensor for a defrost demand. If a defrost demand exists, a defrost cycle will be initiated at the end of the selected time interval. A defrost demand exists when the coil temperature is at or below 32°F for 4 minutes during the interval.

The defrost cycle is terminated when the coil temperature reaches 65°F or 10 minutes has passed.

On 25HNB6 models, defrost will occur in low- or high-stage as demanded by the thermostat or User Interface regardless of OAT

On 25HNB9 models, when OAT is >25°F (-3.9°C), defrost will occur in low- or high-stage as demanded by the thermostat or User Interface.

On 25HNB9 models, if OAT is ≤25°F (-3.9°C), defrost will occur in high-stage only, regardless of thermostat or User Interface demand, and will terminate at 50°F (10°C) coil temperature with a minimum of 2.5 minutes in defrost.

If the coil temperature does not reach 32°F (0°C) within the interval, the interval timer will be reset and start over.

- Upon initial power up the first defrost interval is defaulted to 30 minutes. Remaining intervals are at selected times.
- Defrost is only allowed to occur below 50°F (10°C) outdoor ambient temperature.

The outdoor fan output (ODF) will remain off for 20 seconds after termination. This delay will allow time for the system to capture the heat from the outdoor coil and reduce the “steam cloud” effect that may occur on transition from defrost to the heating cycle. The outdoor fan output OFF delay of 20 seconds may be defeated to enable the fan to energize immediately at the time of termination and 12 seconds prior to the reversing valve de-energizing, through the User Interface setup screen available with SYSTXCCUID01-V UI, or forced defrost pins as follows:

- The ODF fan delay defeat can be toggled by shorting the forced defrost pins for >15 seconds while in the standby mode (status LED on solid). The LED will start to flash when the toggle has taken place.
- Status code 4 shows the fan delay defeat is active (no delay)
- Status code 3 shows that it is not active (20 second delay)

The code will continue to be displayed until after the short is removed. Once the short is removed, there is a 5 second wait before the code is cancelled. The code that is flashing will finish before going back to sold LED. the control is shipped with the ODF fan delay defeat NOT active. the change in status is remembered until toggled to a new status. A power down / power up sequence will not reset the status. It may be necessary to do the toggle twice to cycle to the desired state of defeat.

Defrost Hold

in a non-communicating system, if the thermostat becomes satisfied (Y1 or Y1 and Y2) before the defrost cycle is terminated, the control will "hold" in defrost mode and finish the defrost cycle on the next call for heat.

With communicating Infinity Control, defrost hold is not needed in a communicating system because the User Interface will complete the defrost cycle before shutting down the system.

Forced Defrost

With non-communicating (non-Infinity) control, forced defrost can be initiated by manually shorting the 2-pin header labeled FORCED DEFROST (see Fig 36) on the control board for 5 seconds then releasing.

With communicating (Infinity) control, forced defrost is initiated with the User Interface.

On all models, during a Forced Defrost:

- If coil temperature is at defrost temperature of 32°F, and outdoor air temperature is below 50°F, a full defrost sequence will occur.
- If coil temperature or outdoor air temperature does not meet the above requirements, an abbreviated 30 second defrost will occur.
- Both Quiet Shift and Quiet Shift-2 compressor ON/OFF delays will be included in a forced defrost if either are enabled.

Quiet Shift

Quiet Shift is a field-selectable defrost mode which may eliminate occasional noise that could be heard at the start of the defrost cycle and restarting of the heating cycle. On models with a non-communicating system, this feature must be enabled by selecting the 3rd position of the 3-position dip switch. For models with communicating (Infinity) systems, it must be enabled at the User Interface. When activated, the following sequence of operation will occur. Reversing valve will energize and compressor will turn off for 30 seconds, then turn back on to complete defrost. At the end of the defrost cycle, the reversing valve de-energizes, compressor will turn off for another 30 seconds, and the fan will turn off for 40 seconds, before starting in the heating mode.

Quiet Shift-2 (communicating models) (part # HK38EA016, HK38EA022, HK38EA023)

Quiet Shift-2 is a field selectable defrost mode which may eliminate occasional noise that could be heard at the start and finish of the defrost cycle.

On a non-communicating system, this feature must be enabled by selecting the 3rd position of the 3-position dip switch on the outdoor control board. For communicating systems, it must be enabled at the User Interface. When activated, the following sequence of operation occurs:

Defrost Initiation – The compressor is de-energized for 70 seconds. During this 70 second compressor off time, the reversing valve will be energized. Once the 70 second compressor off time has been reached, the compressor will be energized then the outdoor fan will be de-energized at which time the normal defrost cycle begins.

Defrost Termination – the outdoor fan will be energized shortly before the compressor is de-energized for 60 seconds. During the compressor 60 second off time, the reversing valve will be de-energized. Once the 60 second compressor off time has been completed, the compressor will be energized at which time the system will be in normal heat mode.

Liquid-Line Solenoid Accessory

In heat pump long-line applications, a liquid-line solenoid is required to control refrigerant migration in the heating mode. The solenoid should be installed near the outdoor unit with the arrow facing the outdoor unit. This is the direction of flow control. See application manual for long-line application details.

Accessory Liquid Solenoid with Infinity Communicating Control:

When using the Infinity Control, the liquid-line solenoid output is provided at the Y1 connection. Connect the solenoid as shown in the wiring label diagram. This is a 24vac output that is energized whenever the compressor is energized. It closes, in the compressor off mode, to prevent refrigerant migration into the unit through the liquid-line.

On Models with Accessory Liquid Solenoid Using a Non-Communicating Thermostat:

The liquid solenoid is connect to the Y1 and C terminal connections. The liquid solenoid closes, in the compressor off mode, to prevent refrigerant migration into the unit through the liquid-line.

CHECK CHARGE

All 25HNB6 units must be charged in high stage only.

Factory charge amount and desired subcooling are shown on unit rating plate. Charging method is shown on information plate inside unit. To properly check or adjust charge, conditions must be favorable for subcooling charging. Favorable conditions exist when the outdoor temperature is between 70°F and 100°F (21.11°C and 37.78°C), and the indoor temperature is between 70°F and 80°F (21.11°C and 26.67°C). Follow the procedure below:

Unit is factory charged for 15ft (4.57 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft of 3/8 liquid line above or below 15ft (4.57 m) respectively.

For standard refrigerant line lengths (80 ft/24.38 m or less), allow system to operate in cooling mode at least 15 minutes. If conditions are favorable, check system charge by subcooling method. If any adjustment is necessary, adjust charge slowly and allow system to operate for 15 minutes to stabilize before declaring a properly charged system.

If the indoor temperature is above 80°F (26.67°C), and the outdoor temperature is in the favorable range, adjust system charge by weight based on line length and allow the indoor temperature to drop to 80°F (26.67°C) before attempting to check system charge by subcooling method as described above.

If the indoor temperature is below 70°F (21.11°C), or the outdoor temperature is not in the favorable range, adjust charge for line set length above or below 15ft (4.57 m) only. Charge level should then be appropriate for the system to achieve rated capacity. The charge level could then be checked at another time when the both indoor and outdoor temperatures are in a more favorable range.

NOTE: If line length is beyond 80 ft (24.38 m) or greater than 20 ft (6.10 m) vertical separation, See Long Line Guideline for special charging requirements.

Heating Check Chart Procedure

To check system operation during heating cycle, refer to the Heat Pump Charging Instructions label on outdoor unit. This chart indicates whether a correct relationship exists between system operating pressure and air temperature entering indoor and outdoor units. If pressure and temperature do not match on chart, system

refrigerant charge may not be correct. Do not use chart to adjust refrigerant charge.

NOTE: In heating mode, check refrigerant charge only when pressures are stable. If in doubt, remove charge and weigh in correct refrigerant charge.

NOTE: When charging is necessary during heating season, charge must be weighed in accordance with unit rating plate, ±0.6 oz./ft. of 3/8-in. liquid-line above or below 15 ft., respectively.

EXAMPLE:

To calculate additional charge required for a 25-ft. line set:
25 ft. - 15 ft. = 10 ft. X 0.6 oz./ft. = 6 oz. of additional charge.

SYSTEM FUNCTIONS AND SEQUENCE OF OPERATION (25HNB/24ANB)

The outdoor unit control system has special functions. The following is an overview of the two-stage control functions:

Cooling and Heating Operation

The 25HNB6/24ANB7/25HNB9/24ANB1 model utilizes either a standard 2-stage indoor thermostat or Infinity Communication User Interface. With a call for first stage cooling, the outdoor fan, reversing valve, and low stage compressor are energized. If low-stage cannot satisfy cooling demand, high-stage cooling is energized by the second stage of indoor thermostat or User Interface. After second stage is satisfied, the unit returns to low-stage operation until first stage is satisfied or until second stage is required again. When both first stage and second stage cooling are satisfied, the compressor will shut off. The reversing valve will remain energized until the control board power is removed or a call for heating in initiated. With a call for heating, the outdoor fan and compressor are energized. The compressor will operate in high or low stage operation, as needed to meet the heating demand. When the heating demand is satisfied, the compressor and fan will shut off. The reversing valve is de-energized in the heating mode.

NOTE: When two-stage unit is operating at low-stage, system vapor (suction) pressure will be higher than a standard single-stage system or high-stage operation.

NOTE: Outdoor fan motor will continue to operate for one minute after compressor shuts off, when outdoor ambient is greater than or equal to 100°F. This reduces pressure differential for easier starting on next cycle.

NOTE: If unit has not operated within the past 12 hours, or following a unit power-up, upon the next thermostat high- or low-stage demand, unit operates for a minimum of 5 minutes in high-stage.

On models with non-communicating (non-Infinity) systems, with first stage of cooling, Y1 and O are powered on; and with second stage of cooling, Y1, Y2, and O are on. For these systems, with first stage of heating Y1 is on and for second stage of heating, Y1 and Y2 are on. When the reversing valve is energized, O is powered on.

Communication and Status Function Lights For Infinity Control only, Green communications (COMM) Light

A green LED (**COMM light**) on the outdoor board indicates successful communication with the other system products. The green LED will remain OFF until communication is established. Once a valid command is received, the green LED will turn ON continuously. If no communication is received within 2 minutes, the LED will be turned OFF until the next valid communication.

Amber Status Light

An amber colored **STATUS light** is used to display the operation mode and fault codes as specified in the troubleshooting section. See Table 16 for codes and definitions.

NOTE: Only one code will be displayed on the outdoor unit control board (the most recent, with the highest priority).

Utility Interface With Infinity Control

The utility curtailment relay should be wired between R and Y2 connections on the control board for Infinity Communicating Systems only (see Fig. 36.) This input allows a power utility device to interrupt compressor operation during peak load periods. When the utility sends a signal to shut the system down, the User Interface will display, “Curtailment Active”.

Compressor Operation

The basic scroll design has been modified with the addition of an internal unloading mechanism that opens a bypass port in the first compression pocket, effectively reducing the displacement of the scroll. The opening and closing of the bypass port is controlled by an internal electrically operated solenoid.

The modulated scroll uses a single step of unloading to go from full capacity to approximately 67% capacity. A single speed, high efficiency motor continues to run while the scroll modulates between the two capacity steps. Modulation is achieved by venting a portion of the gas in the first suction pocket back to the low side of the compressor, thereby reducing the effective displacement of the compressor. Full capacity is achieved by blocking these vents, thus increasing the displacement to 100%. A DC solenoid in the compressor controlled by a rectified 24 volt AC signal in the external solenoid plug moves the slider ring that covers and uncovers these vents. The vent covers are arranged in such a manner that the compressor operates at approximately 67% capacity when the solenoid is not energized and 100% capacity when the solenoid is energized.

The loading and unloading of the two step scroll is done “on the fly” without shutting off the motor between steps.

NOTE: 67% compressor capacity translates to approximately 80% cooling or heating capacity at the indoor coil. The compressor will always start unloaded and stay unloaded for five seconds even when the thermostat is calling for high stage.

Fan Motor

Fan motor rotates the fan blade that either draws or blows air through outdoor coil to exchange heat between refrigerant and air. Motors are totally enclosed to increase reliability. This also eliminates need for rain shield.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Turn off all power to unit before servicing or replacing fan motor. Be sure unit main power switch is turned off.

The bearings are permanently lubricated; therefore, no oil ports are provided.

For suspected electrical failures, check for loose or faulty electrical connections, or defective fan-motor capacitor. Fan motor is equipped with thermal overload device in motor windings which may open under adverse operating conditions. Allow time for motor to cool so device can reset. Further checking of motor can be done with an ohmmeter. Set scale on R X 1 position; check for continuity between three leads. Replace motors that show an open circuit in any of the windings. Place 1 lead of ohmmeter on each motor lead. At same time, place other ohmmeter lead on motor case (ground). Replace any motor that shows resistance to ground, signs of arcing, burning, or overheating.

Located above the compressor is a single-speed fan motor and fan. The 24ANB1/25HNB9 air conditioner and heat pump models use the ECM variable speed fan motor.

The outdoor Integral Control Motor (ECM), is a variable-speed motor which operates from 450 to 850 rpm. The motor is a dc permanent magnet-type motor with the electronic controls integrated into its rear cover. The control package includes a small diode bridge, capacitors, and power switching devices. It converts ac to dc power and switches the dc power to the motor windings on and off at various rates to control the motor speed. The speed at which the motor windings are thus commutated is determined by a pulse width modulated (PWM) signal which is received from the control board on the motor control lines.

The PWM signal is created by turning a DC signal on and off once within a given period of time. The signal on time relative to the signal total period defines the percent of the PWM. For example, if the period is 5 sec and the control power is turned on for 1 sec then off, the signal will remain off for 4 sec before turning on again to start the next cycle. The PWM is called a 20 percent duty cycle signal. If the on time is increased to 4 sec of the 5 sec period, the PWM is called an 80 percent duty cycle. The ECM reads the PWM signal and increases the motor speed linearly from minimum speed to maximum speed with the percent duty cycle value of the supplied PWM signal.

Outdoor Fan Motor Operation

There are two different types of motors used in the Infinity 2-stage outdoor units. The 25HNB6 models use a PSC type fan motor, and the speed does not change between high and low speed operation.

On 25HNB9 models, an ECM fan motor is used to achieve higher efficiency ratings of the system. The outdoor unit control energizes outdoor fan anytime compressor is operating, except for defrost or low-ambient cooling. The outdoor fan remains energized if a pressure switch or compressor overload should open. The outdoor fan motor will continue to operate for one minute after the compressor shuts off when the outdoor ambient is greater than or equal to 100°F/37.7°C. This reduces pressure differential for easier starting on next cycle. On 25HNB6/24ANB7 models, the outdoor fan remains energized during the 1-minute compressor staging time delay.

On 25HNB6/24ANB7 models, the outdoor fan motor is a PSC type. A fan relay on the control board turns the fan off and on by opening and closing a high voltage circuit to the motor. It does not change speeds between low and high stage operation.

On 25HNB9/24ANB1 models, the outdoor fan is an ECM type. The motor control is continuously powered with high voltage. The motor speed is determined by electrical pulses provided by the PWM outputs on the control board. The ECM motor RPM adjusts to outdoor conditions as described in Table 14. The PWM output can be measured with a volt meter set to DC volts.

In low ambient cooling (below 55°F/12.7°C), the control board cycles the fan off and on.

Table 14—Outdoor Fan Motor PWM
Outdoor Temp (DC volts, Tolerance +/- 2%)

Model	Low Stage (OAT≤104°F / 40°C)	High Stage (OAT≤104°F / 40°C)	Low & High Stage (OAT>104°F / 40°C)
25HNB924	8.72	9.35	11.90
25HNB936	9.06	10.23	11.90
25HNB948	9.91	11.04	11.90
25HNB960	10.83	11.70	11.90
24ANB124	9.57	10.88	11.90
24ANB136	9.06	10.23	11.90
24ANB148	9.91	11.04	11.90
24ANB160	10.83	11.70	11.90

NOTE: For 25HNB9 models in low-ambient cooling, the PWM output for both high- and low-stage equals the value for low-stage operation below 55°F (12.8°C).

ECM Fan Motor Troubleshooting

If the outdoor fan motor fails to start and run:

- Check the high-voltage supply. The unit need not be running to check high voltage, but the power must be on.
- If the 230vac is present, use Table 14 to check for proper control voltage output to the fan motor from the control board. The control board sends DC voltage signals to the motor through the terminals labeled PWM1 and PWM2 Set a voltmeter on a DC voltage scale and check across these terminals.
- First check voltage with the motor disconnected. If no control voltage is present, check control-board connections. If connections are good, replace the control board.
- If voltage is present, reconnect the motor and check again. Shut down the unit to reconnect the motor and restart the unit to complete this troubleshooting procedure. If control voltage is no longer present or motor fails to respond, check motor connections.
- If connections are good, replace the motor.

Time Delays

The unit time delays include:

- Five minute time delay to start cooling or heating operation when there is a call from the thermostat or user interface. To bypass this feature, momentarily short and release Forced Defrost pins.
- Five minute compressor re-cycle delay on return from a brown-out condition.
- Two minute time delay to return to standby operation from last valid communication (with Infinity only).
- One minute time delay of outdoor fan at termination of cooling mode when outdoor ambient is greater than or equal to 100°F.
- Fifteen second delay at termination of defrost before the auxiliary heat (W1) is de-energized.
- Twenty second delay at termination of defrost before the outdoor fan is energized.
- Thirty second compressor delay when quiet shift enabled.
- Seventy and sixty second compressor delays when Quiet Shift-2 is enabled.
- On 25HCB6, 25HPA6, 25HNB6 models there is a 1 minute time delay between staging from low to high and from high to low capacity. On 25HNB9 models there is no delay; the compressor will change from low to high and from high to low capacity “on the fly” to meet the demand.

Pressure Switches

The Puron® two-stage air conditioner contains two pressure switches to prevent system operation if the pressures get excessively high or low. The air conditioner low pressure switch in the suction line opens at 50 PSI and closes at 95 PSI. The high pressure switch opens at 670 PSI and closes at 470 PSI. Both pressure switch settings are considerably higher than on comparably sized R-22 units. The high and low pressure switches can be identified by their pink stripe on the switch’s electrical wires.

The Puron® two-stage heat pump contains a loss of charge switch in the suction line on 25HNB6 and 25HNB9, and liquid line on 25HCB6 and 25HPA6 which opens at 23 PSI and closes at 55 PSI. See troubleshooting section for sequence when a pressure switch trip occurs.

Muffler, Accumulator, Reversing Valve (RVS)

The Puron® two-stage air conditioners and heat pumps have a compressor discharge line muffler, to dampen sound pressure pulsations.

The Puron® two-stage heat pumps have a specifically designed reversing valve, for Puron® application and an accumulator for storing excess liquid refrigerant during the heating mode to prevent damaging flood-back.

Thermistors

Outdoor Ambient Thermistor

The Puron® two-speed air conditioner and heat pump units have an outdoor ambient air thermistor. The control board must know the outdoor air temperature so it can activate various functions. These functions include:

- Activating the compressor crankcase heater when ever the outdoor unit is in the off cycle.
- The fan motor speed changes for both air conditioner and heat pump on the ECM equipped units.

Outdoor Coil Thermistor (OCT)

The coil or defrost thermistor is the same thermistor used to monitor outdoor air temperature. The control board must know the coil temperature so it can activate various functions. These functions include:

- Frost sensing on heat pumps
- Coil-vs-Ambient temperature relationship
- Low ambient cooling operation

Thermistor Curve

The resistance vs. temperature chart enables the service technicians to check thermistor resistance, regardless of the temperature.

For example, at a 60°F temperature, thermistor resistance should be around 16,000 Ohms. (See Fig. 34.)

We will talk about the thermistor in more detail when we review the control board fault codes.

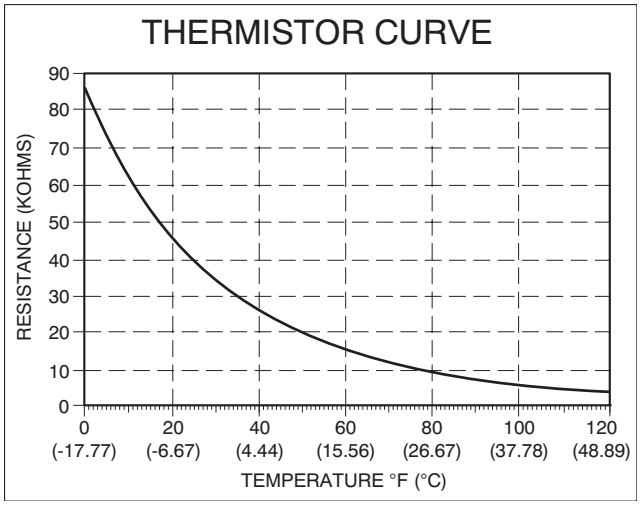

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Fig. 34 – Resistance Values Versus Temperature

Control Box

Contactor And Capacitor

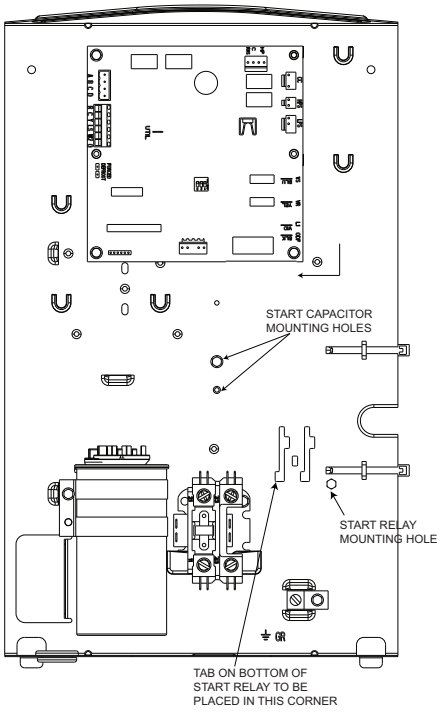
Removal of the information plate exposes the control components. Both air conditioner and heat pump control boxes will appear to be nearly identical. There are two contactors, two capacitors, a control board and a compressor start assist. The contactors are identical to those used in the standard single speed units. One controls low capacity operation and the second controls high speed. The capacitors also are similar to those used in standard single speed units. You have a fan capacitor for the outdoor fan motor, and a run capacitor for the compressor motor. The control board, start capacitor, and start relay control the starting of the compressor.

Always replace these devices with the Factory Approved Components.

Incoming Power

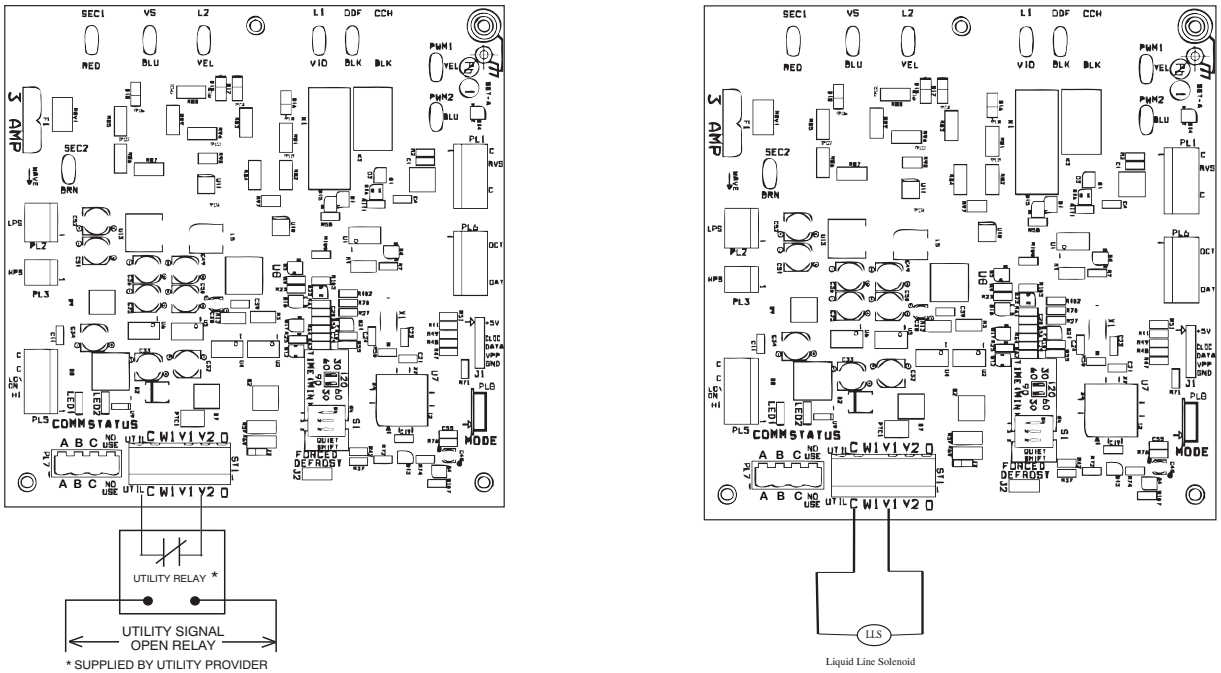
Incoming power is attached to the two power wire stripped leads. A ground lug is also provided. Outdoor unit should always be grounded through the ground lug to the unit disconnect and from the disconnect to the electrical fuse box. Failure to do so can cause serious injury or death.

- First check that the model plug is correct for the unit model and size, and that it is installed properly



A10157

Fig. 35 – Start Relay and Capacitor Mounting Locations Infinity in Cube Cabinet



A12260 A12261

Fig. 36 – 2-Stage Control Board

TROUBLESHOOTING

Troubleshooting circuit board HK38EA016, 022, 023, 026

The Infinity Series outdoor units all use the same control board. A model plug is used to identify the system type, and set the operating parameters for airflow, start circuit timing etc. (see Model Plug section)

Replacement boards may have a different part number from the original board. A newer board will always be backward compatible to previous units if it is superseded at RCD. Old boards are not always forward compatible due to new functions, or software changes made to resolve field issues.

Systems Communication Failure

If communication with the Infinity control is lost with the User Interface, the control will flash the appropriate fault code. (See Table 16.) Check the wiring to the UI and the indoor and outdoor units.

Model Plug

Each control board contains a model plug. The correct model plug must be installed for or the system to operate properly. (See Table 13.)

The model plug is used to identify the type and size of unit to the control. On 25HNB6 models, the model plug is also used to determine the start sequence timing for each individual model.

On new units, the model and serial numbers are input into the board's memory at the factory. If a model plug is lost or missing at initial installation, the unit will operate according to the information input at the factory and the appropriate error code will flash temporarily. An RCD replacement board contains no model and serial information. If the factory control board fails, the model plug must be transferred from the original board to the replacement board for the unit to operate.

NOTE: The model plug takes priority over factory model information input at the factory. If the model plug is removed after initial power up, the unit will operate according to the last valid model plug installed, and flash the appropriate fault code temporarily.

Pressure Switch Protection

The outdoor unit is equipped with high- and low-pressure switches. If the control senses the opening of a high- or low-pressure switch, it will respond as follows:

1. De-energize the appropriate compressor contactor.
2. Keep the outdoor fan operating for 15 minutes.
3. Display the appropriate fault code (see Table 16).
4. After a 15 minute delay, if there is a call for cooling or heating and LPS or HPS is reset, the appropriate compressor contactor is energized.
5. If LPS or HPS has not closed after a 15 minute delay, the outdoor fan is turned off. If the open switch closes anytime after the 15 minute delay, then resume operation with a call for cooling or heating.
6. If LPS or HPS trips 3 consecutive cycles, the unit operation is locked out for 4 hours.
7. In the event of a high-pressure switch trip or high-pressure lockout, check the refrigerant charge, outdoor fan operation, and outdoor coil (in cooling) for airflow restrictions, or indoor airflow in heating.
8. In the event of a low-pressure switch trip or low-pressure lockout, check the refrigerant charge and indoor airflow (cooling) and outdoor fan operation and outdoor coil in heating.

Control Fault

If the outdoor unit control board has failed, the control will flash the appropriate fault code (see Table 16). The control board should be replaced.

Brown-Out Protection

If the line voltage is less than 187v for at least 4 seconds, the appropriate compressor contactor and fan relay are de-energized. Compressor and fan operation are not allowed until voltage is a minimum of 190v. The control will flash the appropriate fault code (see Table 16).

230v Brown-Out Protection Defeated

The brownout feature can be defeated if needed for severe noisy power conditions. This defeat should always be a last resort to solving the problem. Defeat is available on the User Interface setup screen (available with SYSTXBBUID01-C UI) or can be initiated through the forced defrost pins for non-communicating systems as follows:

The brownout toggle is accomplished by shorting the defrost pins from power up with the OAT and OCT sensor connector removed. After 3 seconds, the status of the force defrost short and the OAT/OCT as open will be checked. If correct, then the brownout will be toggled.

- Status code 6 shows the brownout is disabled.
- Status code 5 shows the brownout is active.

After the brownout defeat is set, power down and reinstall the OAT/OCT sensor and remove the short from the forced defrost pins. As long as the short on the forced defrost remains, the OAT and OCT faults will not be cleared. The code will continue to be flashed.

The control is shipped with the brownout active. The change in status is remembered until toggled to a new status. A power down/power up sequence will not reset the status. It may be necessary to do the toggle twice to cycle to the desired state of the defeat.

230V Line (Power Disconnect) Detection

If there is no 230v at the compressor contactor(s) when the indoor unit is powered and cooling or heating demand exists, the appropriate fault code is displayed. Verify the disconnect is closed and 230v wiring is connected to the unit.

Compressor Voltage Sensing

The control board input terminals labeled VS, and L2 on 25HNB6/24ANB7 and 25HNB9/24ANB1 models (see Fig. 36) are used to detect compressor voltage status and alert the user of potential problems. The control continuously monitors the high voltage on the run capacitor of the compressor motor. Voltage should be present any time the compressor contactor is energized and voltage should not be present when the contactor is de-energized.

Contactor Shorted Detection

If there is compressor voltage sensed when there is no demand for compressor operation, the contactor may be stuck closed or there may be a wiring error. The control will flash the appropriate fault code.

Compressor Thermal Cutout - 24ANB1/24ANB7/25HNB6/25HNB9

If the control senses the compressor voltage after start-up and is then absent for 10 consecutive seconds while cooling or heating demand exists, the thermal protector is open. The control de-energizes the compressor contactor for 15 minutes, but continues to operate the outdoor fan. The control Status LED will flash the appropriate code shown in Table 16. After 15 minutes, with a call for low or high stage cooling or heating, the compressor contactor is energized. If the thermal protector has not re-set, the outdoor fan is turned off. If the call for cooling or heating continues, the control will energize the compressor contactor every 15 minutes. If the thermal protector closes, (at the next 15 minute interval check) the unit will resume operation.

If the thermal cutout trips for three consecutive cycles, then unit operation is locked out for 4 hours and the appropriate fault code is displayed.

Low or High Contactor Open / No 230V at Compressor Contractor 24ANB1/24ANB7/25HNB6/25HNB9

If the compressor voltage is not sensed when the compressor should be starting, the appropriate contactor may be stuck open or there is a wiring error. The control will flash the appropriate fault code. Check the contactor and control box wiring.

Troubleshooting units for proper switching between low & high stages - 24ANB1/24ANB7/25HNB6/25HNB9

Check the suction pressures at the service valves. Suction pressure should be reduced by 3-10% when switching from low to high capacity.

NOTE: The liquid pressures are very similar between low and high stage operation, so liquid pressure should not be used for troubleshooting.

Compressor current should increase 20-45% when switching from low to high stage. The compressor solenoid when energized in high stage, should measure 24vac.

When the compressor is operating in low stage the 24v DC compressor solenoid coil is de-energized. When the compressor is operating in high stage, the 24v DC solenoid coil is energized. The solenoid plug harness that is connected to the compressor HAS an internal rectifier that converts the 24v AC signal to 24v DC. **DO NOT INSTALL A PLUG WITHOUT AN INTERNAL RECTIFIER.**

Unloader Test Procedure - 24ANB1/24ANB7/25HNB6/25HNB9

The unloader is the compressor internal mechanism, controlled by the DC solenoid, that modulates between high and low stage. If it is suspected that the unloader is not working, the following methods may be used to verify operation.

1. Operate the system and measure compressor amperage. Cycle the unloader on and off at 30 second plus intervals at the UI (from low to high stage and back to low stage). Wait 5 seconds after staging to high before taking a reading. The compressor amperage should go up or down at least 20 percent.
2. If the expected result is not achieved, remove the solenoid plug from the compressor and with the unit running and the UI calling for high stage, test the voltage output at the plug with a DC voltmeter. The reading should be 24 volts DC.
3. If the correct DC voltage is at the control circuit molded plug, measure the compressor unloader coil resistance. The resistance should be approximately 330 or 1640 ohms depending on unloader coil supplier. If the coil resistance is infinite or is grounded, the compressor must be replaced.

Temperature Thermistors

Thermistors are electronic devices which sense temperature. As the temperature increases, the resistance decreases. Thermistors are used to sense outdoor air (OAT) and coil temperature (OCT). Refer to Fig. 34 for resistance values versus temperature.

If the outdoor air or coil thermistor should fail, the control will flash the appropriate fault code. (See Table 16)

IMPORTANT: The outdoor air thermistor and coil thermistor should be factory mounted in the final locations. Check to ensure thermistors are mounted properly per Fig. 37 and Fig. 38.

Thermistor Sensor Comparison

The control continuously monitors and compares the outdoor air temperature sensor and outdoor coil temperature sensor to ensure proper operating conditions. The comparison is:

- In cooling if the outdoor air sensor indicates ≥ 10°F warmer than the coil sensor (or) the outdoor air sensor indicates ≥ 20°F cooler than the coil sensor, the sensors are out of range.
- In heating if the outdoor air sensor indicates ≥ 35°F warmer than the coil sensor (or) the outdoor air sensor indicates ≥ 10°F cooler than the coil sensor, the sensors are out of range.

If the sensors are out of range, the control will flash the appropriate fault code as shown in Table 16.

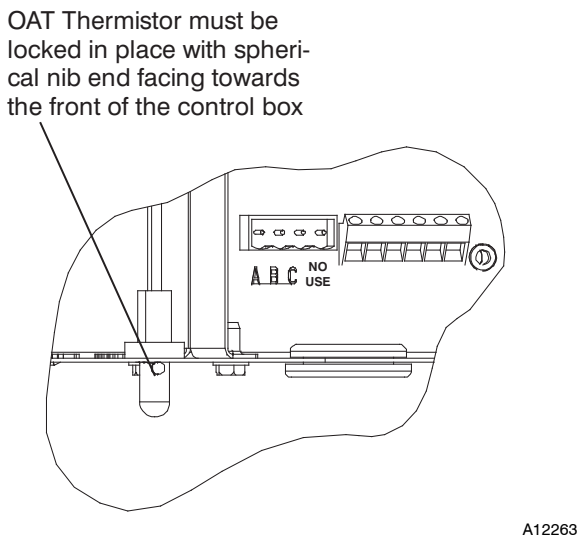


Fig. 37 – Outdoor Air Thermistor (OAT) Attachment

The thermistor comparison is not performed during low ambient cooling or defrost operation.

Failed Thermistor Default Operation

Factory defaults have been provided in the event of failure of outdoor air thermistor (OAT) and/or outdoor coil thermistor (OCT).

If the OAT sensor should fail, low ambient cooling will not be allowed and the one-minute outdoor fan off delay will not occur. Defrost will be initiated based on coil temperature and time.

If the OCT sensor should fail, low ambient cooling will not be allowed. Defrost will occur at each time interval during heating operation, but will terminate after 5 minutes.

If there is a thermistor out of range error, defrost will occur at each time interval during heating operation, but will terminate after 5 minutes.

Count the number of short and long flashes to determine the appropriate flash code. Table 16 gives possible causes and actions related to each error.

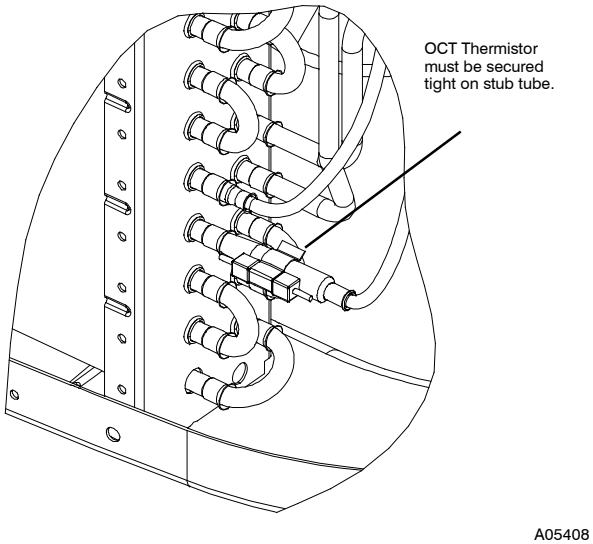


Fig. 38 – Outdoor Coil Thermistor (OCT) Attachment

Table 15—Two- Stage Compressor Resistances
(Winding Resistance at 70°F±20°)

Winding	024	036	048	060
Start (S- C)	1.64	1.52	1.86	1.63
Run (R- C)	1.30	0.88	0.52	0.39

Status Codes

Table 16 shows the status codes flashed by the amber status light. Most system problems can be diagnosed by reading the status code as flashed by the amber status light on the control board.

The codes are flashed by a series of short and long flashes of the status light. The short flashes indicate the first digit in the status code, followed by long flashes indicating the second digit of the error code.

The short flash is 0.25 seconds ON and the long flash is 1.0 second ON. Time between flashes is 0.25 seconds. Time between short flash and first long flash is 1.0 second. Time between code repeating is 2.5 seconds with LED OFF.

EXAMPLE:

3 short flashes followed by 2 long flashes indicates a 32 code. Table 16 shows this to be low pressure switch open.

Table 16—TROUBLESHOOTING

OPERATION	FAULT	AMBER LED FLASH CODE	POSSIBLE CAUSE AND ACTION
Standby – no call for unit operation	None	On solid, no flash	Normal operation
Low Stage Cool/Heat Operation	None	1, pause	Normal operation
High Stage Cool/Heat Operation	None	2, pause	Normal operation
Brown out protection is Disabled	None	5, pause	User made selection, see instructions for more detail
Brown out protection is Active	None	6, Pause	User made selection, see instructions for more detail
	System Communications Failure	16	Communication with User Interface lost. Check wiring to User Interface, indoor and outdoor units
	Invalid Model Plug	25	Control does not detect a model plug or detects an invalid model plug. Unit will not operate without correct model plug.
	High Pressure Switch or Discharge Temp Switch Open	31*	High- pressure switch trip. Check refrigerant charge, outdoor fan operation and coils for airflow restrictions.
	Low Pressure Switch Open	32*	Low- pressure switch trip. Check refrigerant charge and indoor air flow.
	Control Fault	45	Outdoor unit control board has failed. Control board needs to be replaced.
	Brown Out (230 v)	46	Line voltage < 187v for at least 4 seconds. Compressor and fan operation not allowed until voltage≥190v. Verify line voltage.
	No 230v at Unit	47	There is no 230v at the contactor when indoor unit is powered and cooling/heating demand exists. Verify the disconnect is closed and 230v wiring is connected to the unit.
	Outdoor Air Temp Sensor Fault	53	Outdoor air sensor not reading or out of range. Ohm out sensor and check wiring.
	Outdoor Coil Sensor Fault	55	Coil sensor not reading or out of range. Ohm out sensor and check wiring.
	Thermistors out of range	56	Improper relationship between coil sensor and outdoor air sensor. Ohm out sensors and check wiring.
	Low Stage Thermal Cutout	71*	Compressor operation detected then disappears while low stage demand exists. Possible causes are internal compressor overload trip or start relay and capacitor held in circuit too long (if installed).
	High Stage Thermal Cutout	72*	Compressor operation detected then disappears while high stage demand exists. Possible causes are internal compressor overload trip or start relay and capacitor held in circuit too long (if installed).
	Contactor Shorted	73	Compressor voltage sensed when no demand for compressor operation exists. Contactor may be stuck closed or there is a wiring error.
	No 230V at Compressor	74	Compressor voltage not sensed when compressor should be starting. Contactor may be stuck open or there is a wiring error.
	Low Stage Thermal Lockout	81	Thermal cutout occurs in three consecutive low/high stage cycles. Low stage locked out for 4 hours or until 24v power recycled.
	High Stage Thermal Lockout	82	Thermal cutout occurs in three consecutive high/low stage cycles. High stage locked out for 4 hours or until 24v power recycled.
	Low- Pressure Lockout	83	Low pressure switch trip has occurred during 3 consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.
	High- Pressure Lockout	84	High pressure switch trip has occurred during 3 consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.

* Sequence: Compressor contactor is de- energized and outdoor fan is energized for up to 15 minutes. If demand still exists, control will energize compressor contactor after 15 minute delay. If fault is cleared, unit will resume operation. If fault still exists, fan shuts off, and error code continues to flash. Control will attempt re- start every 15 minutes. Cycling low voltage defeats the 15 minute delay.

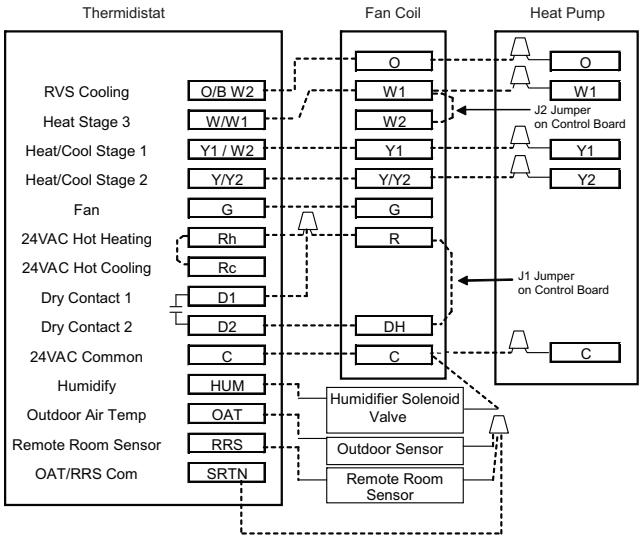


Fig. 39 – Thermidistat Models T6-PRH-01 or T6-NRH-01) Wiring with 2-Stage Heat Pump (non-communicating)

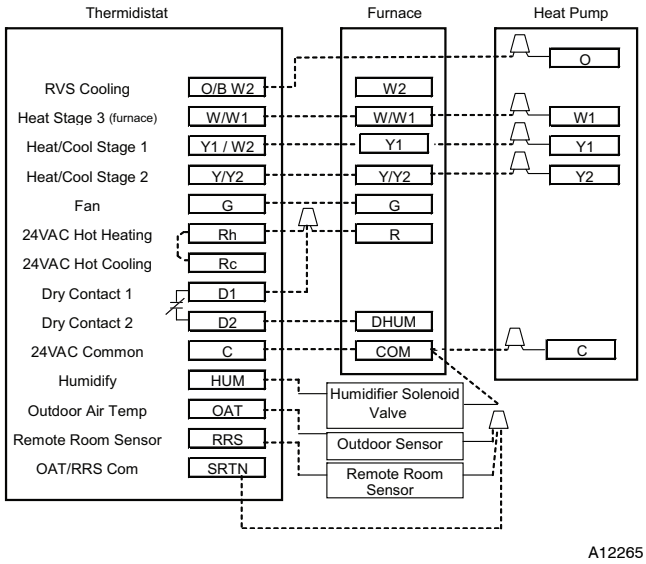


Fig. 40 – Thermidistat Model T6-PRH-01 or T6-NRH-01 with Variable Speed Furnace and 2-Stage Heat Pump (non-communicating)

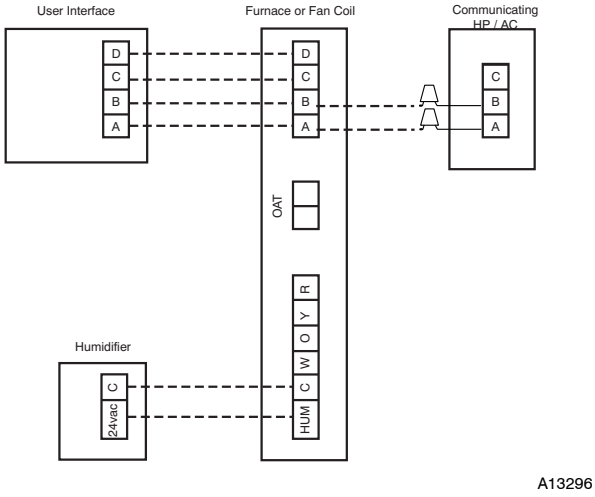


Fig. 41 – Variable Speed Furnace or Fan Coil Wiring with Communicating 2-Stage HP / AC

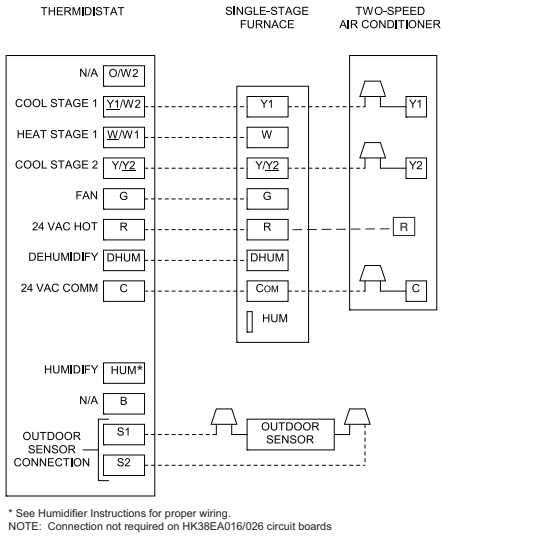


Fig. 42 – Single Stage Furnace with 2-Stage Air Conditioner

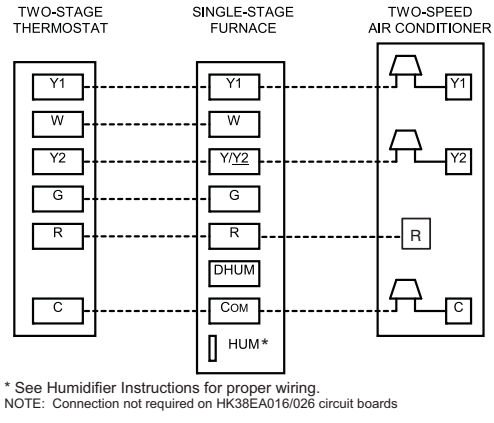
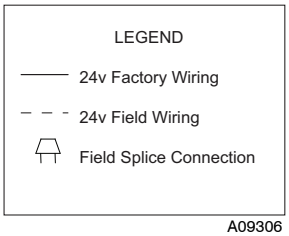


Fig. 43 – 2-Stage Thermostat with Single-Stage Furnace and 2-Stage Air Conditioner



TWO STAGE NON-COMMUNICATING 24ACB7/25HCB6

These units are a low cost 2-stage option that is non-communicating utilizing 2 stage scroll technology. These units require Performance Boost furnace (58PH, 58MEB), variable speed furnace (58MV, 58CV) or new model variable speed fan coil (FV4C). Variable speed fan coils prior to the FV4C will NOT be rated with the new Comfort series two stage units as they are not capable of meeting the air flow requirements necessary for rating. These are designed to operate with basic 24 volt thermostat inputs.

Operating Ambient

The minimum outdoor operating ambient in cooling mode is 55°F (12.78°C), and the maximum outdoor operating ambient in cooling mode is 125°F (51.67°C) when operating voltage is 230v. For 208v applications, the maximum outdoor ambient is 120°F.

NOTE: Units operating at high stage operation, 208v (or below) line voltage and at an outdoor ambient of 120°F (or greater), may experience compressor trip.

NOTE: This product is not approved for low ambient cooling at this time, and no low ambient kit is available.

Airflow Selections (ECM Furnaces)

The ECM Furnaces provide blower operation to match the capacities of the compressor during high and low stage cooling operation. Tap selections on the furnace control board enable the installing technician to select the proper airflows for each stage of cooling. Below is a brief summary of the furnace airflow configurations

1. The Y2 call for high stage cooling energizes the “Cool” tap on the control board. The grey wire from cool tap is connected to tap 5 on the motor. Refer to the furnace Product Data to find the corresponding airflow. If the airflow setting for high cooling needs to be switched from tap 5 to a different tap, jumper a connection from the cool tap to the desired tap so that the Y2 signal is communicated via the cool tap to the desired speed tap.
2. The Y1 call for low stage cooling energizes the “Fan” tap on the control board. The red wire from the fan tap is connected to tap 1 on the motor. Refer to the furnace Product Data to find the corresponding airflow. If the airflow setting for low cooling needs to be switched from tap 1 to a different tap, jumper a connection from the Fan tap to the desired tap so that the Y1 signal is communicated via the Fan tap to the desired speed tap. The Y1 setting will also govern the continuous fan airflow for the furnace.

Refer to the literature for the furnace for further details.

Airflow Selection for Variable Speed Furnaces (non-communicating)

The variable speed furnaces provide blower operation to match the capacities of the compressor during high and low stage cooling operation. The furnace control board allows the installing technician to select the proper airflows for each stage of cooling. Below is a summary of required adjustments. See furnace installation instructions for more details:

1. Turn SW1-5 ON for 400 CFM/ton airflow or OFF for 350 CFM/ton airflow. Factory default is OFF.
2. The A/C DIP switch setting determines airflow during high stage cooling operation. Select the A/C DIP switch setting corresponding to the available airflow shown in the furnace Installation Instructions that most closely matches the required airflow shown in the air conditioning Product Data for HIGH speed.
3. The CF DIP switch setting determines airflow during low stage cooling operation. Select the CF DIP switch setting corresponding to the available airflow shown in the furnace installation instructions that most closely matches the required airflow shown in the air conditioning Product Data for LOW speed. If a higher or lower continuous fan speed is desired, the continuous fan speed can be changed using the fan switch on the thermostat. Refer to the furnace Installation Instructions for details of how to use this feature.

Airflow Selection for FV4C Fan Coils (non-communicating)

The FV4 provides high- and low-stage blower operation to match the capacities of the compressor at high- and low-stage.

To select recommended airflow, refer to the FV4C Installation Instructions. The FV4C utilizes an Easy Select control board that allows the installing technician to select proper airflows. This fan coil has an adjustable blower-off delay factory set at 90 sec. for high- and low-stage blower operation.

SYSTEM FUNCTION AND SEQUENCE OF OPERATION (24ACB7/25HCB6)

NOTE: Defrost control board is equipped with 5 minute lockout timer that is initiated upon any interruption of power.

Turn on power to indoor and outdoor units. Transformer is energized.

These models utilize a 2-stage indoor thermostat. With a call for first (low) stage cooling or heating, the outdoor fan and low-stage compressor are energized. If low-stage cannot satisfy cooling or heating demand, high-stage is energized by the second (high) stage of the indoor thermostat. After the second stage is satisfied, the unit returns to low-stage operation until second stage is required again. When both, first and second stage cooling or heating are satisfied, the compressor will shut off.

Cooling

With first stage cooling, Y and O are powered on; and with second stage cooling, Y2, Y and O are powered on. The O energizes the reversing valve, switching it to cooling position. The Y signal sends low voltage through the safeties and energizes the T1 terminal on the circuit board. If the compressor has been off for 5 minutes, or power has not been cycled for 5 minutes, the OF2 relay and T2 terminal will energize. This will close the contactor and start the outdoor fan motor and compressor. When the cycle is complete, Y is turned off, stopping the compressor and outdoor fan. The 5 minute time guard begins counting. Compressor will not come on until this delay expires. In the event of a power interruption, the time guard will not allow another cycle for 5 minutes.

Heating

With first stage heating, Y is powered on; with second stage heating, Y2 and Y are powered on. The Y signal sends low voltage through the safeties and energizes the T1 terminal on the circuit board. If the compressor has been off for 5 minutes or power has not been cycled for 5 minutes, the OF2 relay and T2 terminal will energize. This will close the contactor and start the outdoor fan motor and compressor.

When the cycle is complete, Y is turned off, stopping the compressor nd outdoor fan. The 5 minute time guard begins counting. Compressor will not come on until this delay expires. In the event of a power interruption, the time guard will not allow another cycle for 5 minutes.

Compressor Operation

The basic scroll design has been modified with the addition of an internal unloading mechanism that opens a by-pass port in the first compression pocket, effectively reducing the displacement of the scroll. The opening and closing of the by-pass port is controlled by an internal electrically operated solenoid. The modulated scroll uses a single step of unloading to go from full capacity to approximately 67% capacity.

A single speed, high efficiency motor continues to run while the scroll modulates between the two capacity steps. Modulation is achieved by venting a portion of the gas in the first suction pocket back to the low side of the compressor, thereby reducing the effective displacement of the compressor.

Full capacity is achieved by blocking these vents, thus increasing the displacement to 100%. A DC solenoid in the compressor controlled by a rectified 24 volt AC signal in the external solenoid plug moves the slider ring that covers and uncovers these vents.

The vent covers are arranged in such a manner that the compressor operates at approximately 67% capacity when the solenoid is not energized and 100% capacity when the solenoid is energized. The loading and unloading of the two step scroll is done ”on the fly” without shutting off the motor between steps.

NOTE: 67% compressor capacity translates to approximately 75% cooling or heating capacity at the indoor coil.

The compressor will always start unloaded and stay unloaded for five seconds even when the thermostat is calling for high stage capacity.

Quiet Shift

Quiet shift is a field selectable defrost mode (factory set to OFF), which will eliminate occasional noise that could be heard at the start of defrost cycle and restarting of heating cycle. It is selected by placing DIP switch 3 on defrost board (see Fig. 44) in the ON position.

When Quiet Shift switch is placed in ON position, and a defrost is initiated, the following sequence of operation will occur. Reversing valve will energize, compressor will turn off for 30 seconds, and then turn back on to complete defrost. At the start of heating after conclusion of defrost, reversing valve will de-energize, compressor will turn off for another 30 seconds, and the fan will turn off for 40 seconds, before starting in the heating mode.

HK32EA008 Defrost Control

The HK32EA008 defrost control is used in all non-communicating heat pumps and has all the same functionality, speedups, and troubleshooting as the HK32EA003 except for the forced defrost timing when Quiet Shift-2 is enabled.

Quiet Shift-2 (non-communicating)

Quiet shift-2 is a field selectable defrost mode (factory set to OFF), which will reduce the occasional noise that could be heard at the start of defrost cycle and restarting of heating cycle. It is selected by placing DIP switch 3 on defrost board in the ON position.

When Quiet Shift-2 switch is placed in ON position, and defrost is initiated, the following sequence of operation will occur: The compressor will be de-energized for approximately 1 minute, then the reversing valve will be energized. A few seconds later, the compressor will be re-energized and the normal defrost cycle starts. Once defrost termination conditions have been met, the following sequence will occur: The compressor will be de-energized for approximately 1 minute, then the reversing valve will be de-energized. A few seconds later, the compressor will be re-energized and the normal heating cycle starts.

Defrost

The defrost control is a time/temperature control which has field selectable settings of 30, 60, 90, or 120 minutes, factory set to 90 minutes. These settings represent the amount of time that must pass after closure of the defrost thermostat before the defrost sequence begins.

The defrost thermostat senses coil temperature throughout the heating cycle. When the coil temperature reaches the defrost thermostat setting of approximately 32°F (0°C), it will close, which energizes the DFT terminal and begins the defrost timing sequence. When the DFT has been energized for the selected time, the defrost cycle begins. Defrost cycle is terminated when defrost thermostat opens, or automatically after 10 minutes.

Defrost Speedup

To initiate a forced defrost, speedup pins (J1) must be shorted with a flat head screwdriver for 5 seconds and **RELEASED**. If the defrost thermostat is open, a short defrost cycle will be observed (actual length depends on Quiet Shift switch position). When Quiet Shift is off, only a short 30 second defrost cycle is observed. With Quiet Shift ON, the speedup sequence is one minute; 30 second compressor off period followed by 30 seconds of defrost with compressor operation. When returning to heating mode, the compressor will turn off for an additional 30 seconds and the fan for 40 seconds.

If the defrost thermostat is closed, a complete defrost cycle is initiated. If the Quiet Shift switch is turned on, the compressor will be turned off for two 30 second intervals as explained previously.

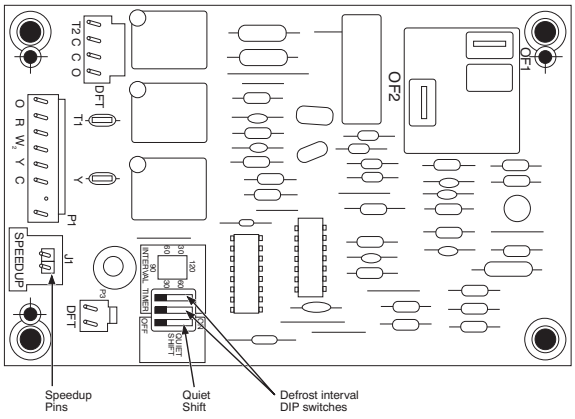


Fig. 44 – Defrost Control

CHECK CHARGE

Factory charge amount and desired subcooling are shown on unit rating plate. Charging method is shown on information plate inside unit. To properly check or adjust charge, conditions must be favorable for subcooling charging. Favorable conditions exist when the outdoor temperature is between 70°F and 100°F (21.11°C and 37.78°C), and the indoor temperature is between 70°F and 80°F (21.11°C and 26.67°C). Follow the procedure below:

Unit is factory charged for 15ft (4.57 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft (.018 kg/m) of 3/8 liquid line above or below 15ft (4.57 m) respectively.

For standard refrigerant line lengths (80 ft/24.38 m or less), allow system to operate in cooling mode at least 15 minutes. If conditions are favorable, check system charge by subcooling method. If any adjustment is necessary, adjust charge slowly and allow system to operate for 15 minutes to stabilize before declaring a properly charged system.

If the indoor temperature is above 80°F (26.67°C), and the outdoor temperature is in the favorable range, adjust system charge by weight based on line length and allow the indoor temperature to drop to 80°F (26.67°C) before attempting to check system charge by subcooling method as described above.

If the indoor temperature is below 70°F (21.11°C), or the outdoor temperature is not in the favorable range, adjust charge for line set length above or below 15ft (4.57 m) only. Charge level should then be appropriate for the system to achieve rated capacity. The charge level could then be checked at another time when the both indoor and outdoor temperatures are in a more favorable range.

NOTE: If line length is beyond 80 ft (24.38 m) or greater than 20 ft (6.10 m) vertical separation, See Long Line Guideline for special charging requirements.

Heating Check Chart Procedure

To check system operation during heating cycle, refer to the Heating Check Chart on outdoor unit. This chart indicates whether a correct relationship exists between system operating pressure and air temperature entering indoor and outdoor units. If pressure and temperature do not match on chart, system refrigerant charge may not be correct. Do not use chart to adjust refrigerant charge.

Verify 25HCB6 units for proper switching between low & high stages

Check the suction pressures at the service valves. Suction pressure should be reduced by 3-10% when switching from low to high capacity.

Compressor current should increase 20-45% when switching from low to high stage. The compressor solenoid when energized in high stage, should measure 24vac.

When the compressor is operating in low stage the 24v DC compressor solenoid coil is de-energized. When the compressor is operating in high stage, the 24v DC solenoid coil is energized. The solenoid plug harness that is connected to the compressor has an internal rectifier that converts the 24v AC signal to 24v DC. **DO NOT INSTALL A PLUG WITHOUT AN INTERNAL RECTIFIER.**

Unloader Test Procedure

The unloader is the compressor internal mechanism, controlled by the DC solenoid, that modulates between high and low stage. If it is suspected that the unloader is not working, the following methods may be used to verify operation.

1. Operate the system and measure compressor amperage. Cycle the unloader on and off at 30 second plus intervals at the thermostat (from low to high stage and back to low stage). Wait 5 seconds after staging to high before taking a reading. The compressor amperage should go up or down at least 20 percent.
2. If the expected result is not achieved, remove the solenoid plug from the compressor and with the unit running and the thermostat calling for high stage, test the voltage output at the plug with a DC voltmeter. The reading should be 24 volts DC.
3. If the correct DC voltage is at the control circuit molded plug, measure the compressor unloader coil resistance. The resistance should be approximately 330 or 1640 ohms depending on unloader coil supplier. If the coil resistance is infinite or is grounded, the compressor must be replaced.

CARE AND MAINTENANCE

To assure high performance and minimize possible equipment malfunction, it is essential that maintenance be performed periodically on this equipment. The frequency with which maintenance is performed is dependent on such factors as hours of operation, geographic location, and local environmental conditions.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect all electrical power to unit before performing any maintenance or service on outdoor unit. Remember to disconnect power supply to air handler as this unit supplies low-voltage power to the outdoor unit.

The minimum maintenance that should be performed on this equipment is as follows:

1. Check outdoor coil for cleanliness each heating and cooling season and clean as necessary.
2. Check fan motor and blade for cleanliness each month during cooling season and clean as necessary.
3. Check electrical connections for tightness and controls for proper operation each cooling season and service as necessary.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Because of possible damage to the equipment or personal injury, maintenance should be performed by qualified personnel only.

Desert and Seacoast Locations

Special consideration must be given to installation and maintenance of condensing units installed in coastal or desert locations. This is because salt and alkali content of sand adheres to aluminum fins of coil and can cause premature coil failure due to corrosion.

Preventive measures can be taken during installations, such as:

1. Locate unit on side of structure opposite prevailing winds.
2. Elevate unit to height where drifting sand cannot pile up against coil. Mounting feet, 4 in. high, are available as accessories and can be used to elevate unit.
3. Addition of coastal filter (See Product Data Digest for accessory listing).

Maintenance in desert and seacoast locations:

1. Frequent inspection of coil and basepan especially after storms and/or high winds.
2. Clean coil by flushing out sand from between coil fins and out of basepan as frequently as inspection determines necessary.
3. In off season, cover with covering that allows air to circulate through but prevents sand from sifting in (such as canvas material). Do not use plastic as plastic will hold moisture possibly causing corrosion.

Cleaning Coil

1. Remove top cover. (See Remove Top Cover in Cabinet section of this manual.)
2. Remove coil grilles or louvers (as applicable) to gain full access to coils for cleaning.

NOTE: 4-sided deluxe units employ one louver spacer on each of the four sides to prevent louver movement during operation. The louver spacers are trapped between the coil surface and louver at the approximate center of each side (See Fig. 45). This louver spacer should be present and, if dislodged during shipment, must be reinstalled before unit is placed into operation.

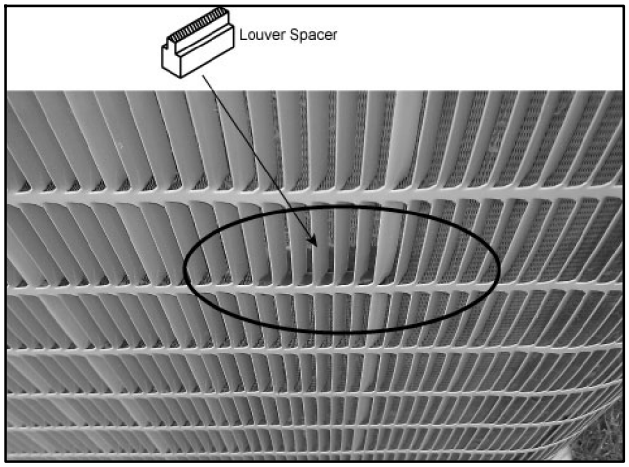


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Fig. 45 – Louver Spacer Location

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Coil fin damage can result in higher operating costs or compressor damage. Do not use flame, high-pressure water, steam, volatile or corrosive cleaners on fins or tubing.

3. Clean coil using vacuum cleaner and its crevice tool. Move crevice tool vertically, close to area being cleaned, making sure tool touches only dirt on fins and not fins. to prevent fin damage, do not scrub fins with tool or move tool horizontally against fins.
4. If oil deposits are present, spray coil with ordinary household detergent. Wait 10 minutes, and proceed to next step.
5. Using garden hose, spray coil vertically downward with constant stream of water at moderate pressure. Keep nozzle at a 15- to 20° angle, about 3 in. from coil face and 18 in. from tube. Spray so debris is washed out of coil and basepan.
6. Reinstall top cover and position blade.
7. Reconnect electrical power and check for proper operation.

Cleaning Outdoor Fan Motor and Blade

1. Remove fan motor and blade. Be careful not to bend or dent fan blade.
2. Clean motor and blade with soft brush or cloth. Be careful not to disturb balance weights on fan blade.
3. Check fan blade setscrew for tightness.
4. Reinstall fan motor and blade to top cover and check for alignment.
5. Reinstall top cover and position blade.
6. Reconnect electrical power and check for proper operation.

Electrical Controls and Wiring

1. Disconnect power to both outdoor and indoor units.
2. Check all electrical connections for tightness. Tighten all screws on electrical connections. If any connections appear to be burned or smoky, disassemble the connection, clean all parts and stripped wires, and reassemble. Use a new connector if old one is burned or corroded, and crimp tightly.
3. Reconnect electrical power to indoor and outdoor units and observe unit through 1 complete operating cycle.
4. If there are any discrepancies in operating cycle, troubleshoot to find cause and correct.

Refrigerant Circuit

1. Check refrigerant charge using the superheat method, and if low on charge, check unit for leaks using an electronic leak detector.
2. If any leaks are found, remove and reclaim or isolate charge (pumpdown) if applicable. Make necessary repairs.
3. Evacuate, recharge, and observe unit through 1 complete operating cycle.

Final Check-Out

After the unit has been operating, the following items should be checked.

1. Check that unit operational noise is not excessive due to vibration of component, tubing, panels, etc. If present, isolate problem and correct.
2. Check to be sure caps are installed on service valves and are tight.
3. Check to be sure tools, loose parts, and debris are removed from unit.
4. Check to be sure all panels and screws are in place and tight.

PURON® (R-410A) REFRIGERANT QUICK REFERENCE GUIDE

- Puron refrigerant operates at 50-70 percent higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with Puron refrigerant.
- Puron refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- Puron refrigerant systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low-side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- Puron refrigerant, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid-line filter driers with rated working pressures less than 600 psig.
- Do not leave Puron refrigerant suction line filter driers in line longer than 72 hours.
- Do not install a suction-line filter drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory approved liquid-line filter drier is required on every unit.
- Do NOT use an R-22 TXV.
- If indoor unit is equipped with an R-22 TXV or piston metering device, it must be changed to a hard shutoff Puron TXV.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent Puron refrigerant into the atmosphere.
- Do not use capillary tube coils.
- Observe all **warnings**, **cautions**, and **bold** text.
- All indoor coils must be installed with a hard shutoff Puron TXV metering device.

AIR CONDITIONER TROUBLESHOOTING CHART

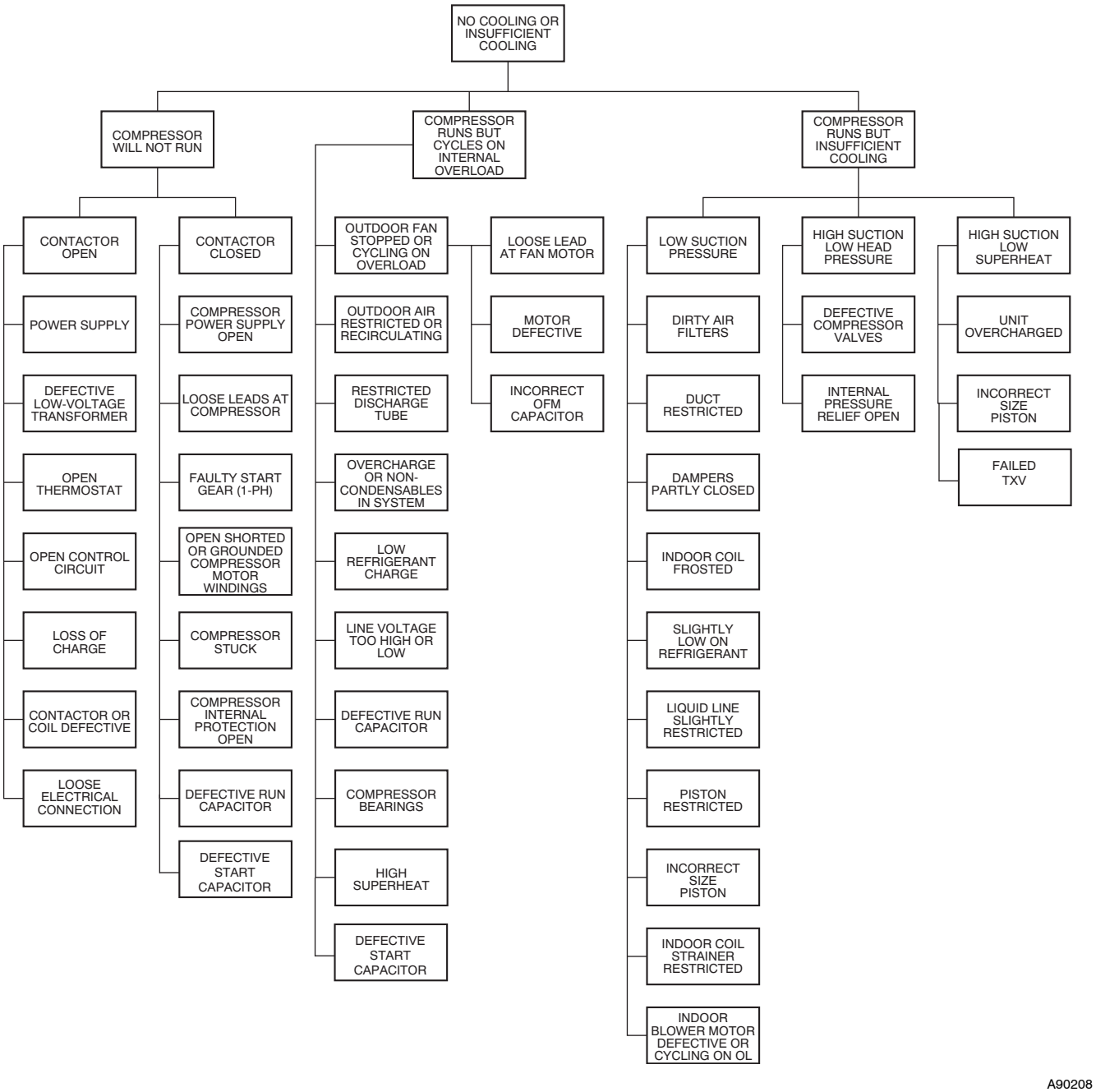

Fig. 46 – Air Conditioner Troubleshooting Chart

HEAT PUMP
TROUBLESHOOTING HEATING CYCLE

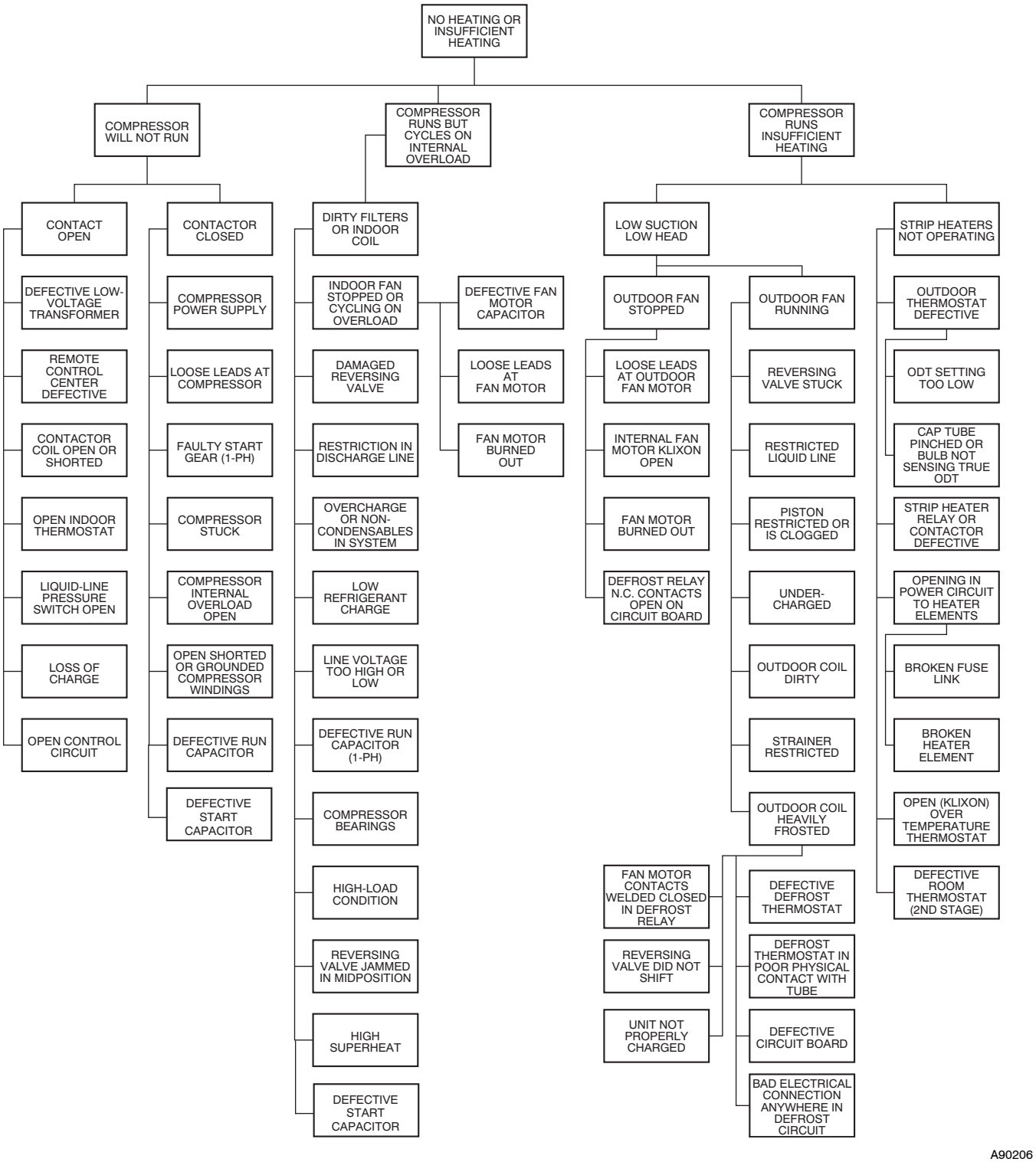

Fig. 47 – Heat Pump Troubleshooting - Heating Cycle

HEAT PUMP
TROUBLESHOOTING COOLING CYCLE

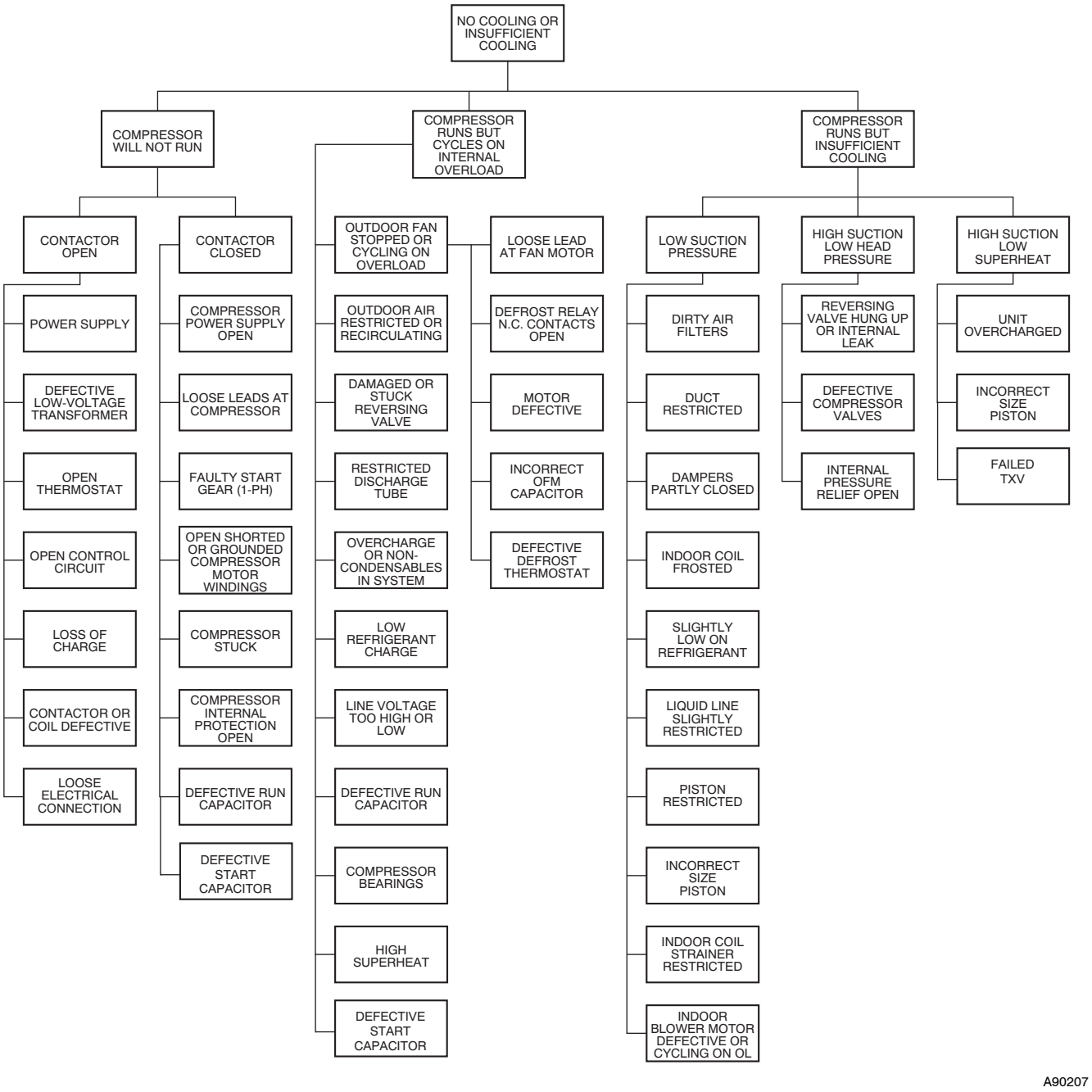

Fig. 48 – Heat Pump Troubleshooting - Cooling Cycle

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Edition Date: 08/13

Catalog No.24-25-5SM

Replaces:24-25-4SM

25HBB, 25HBC, 25HCD Comfort™ Series Heat Pumps with Puron® Refrigerant 1–1/2 To 5 Nominal Tons

Carrier
turn to the experts

Installation Instructions

NOTE: Read the entire instruction manual before starting the installation.

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory–authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70. In Canada, refer to current editions of the Canadian electrical code CSA 22.1.

Recognize safety information. This is the safety–alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety–alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage.

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

INSTALLATION RECOMMENDATIONS

NOTE: In some cases noise in the living area has been traced to gas pulsations from improper installation of equipment.

1. Locate unit away from windows, patios, decks, etc. where unit operation sound may disturb customer.
2. Ensure that vapor and liquid tube diameters are appropriate for unit capacity.
3. Run refrigerant tubes as directly as possible by avoiding unnecessary turns and bends.
4. Leave some slack between structure and unit to absorb vibration.
5. When passing refrigerant tubes through the wall, seal opening with RTV or other pliable silicon–based caulk (see Fig. 1).
6. Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, and walls.
7. Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap which comes in direct contact with tubing (see Fig. 1).
8. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
9. When necessary, use hanger straps which are 1 in. wide and conform to shape of tubing insulation (see Fig. 1).
10. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.

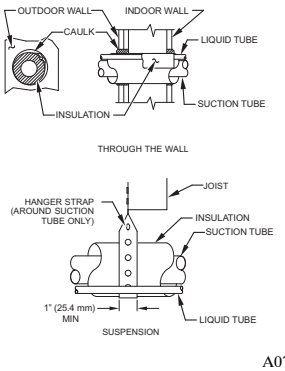


Fig. 1 - Connecting Tubing Installation

When outdoor unit is connected to factory–approved indoor unit, outdoor unit contains system refrigerant charge for operation with AHRI rated indoor unit when connected by 15 ft. (4.57 m) of field–supplied or factory accessory tubing. For proper unit operation, check refrigerant charge using charging information located on control box cover and/or in the Check Charge section of this instruction.

IMPORTANT: Maximum liquid–line size is 3/8–in. OD for all residential applications including long line.

IMPORTANT: Always install the factory–supplied liquid–line filter drier. Obtain replacement filter driers from your distributor or branch.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Check Equipment and Job Site

Unpack Unit

Move to final location. Remove carton taking care not to damage unit.

Inspect Equipment

File claim with shipping company prior to installation if shipment is damaged or incomplete. Locate unit rating plate on unit corner panel. It contains information needed to properly install unit. Check rating plate to be sure unit matches job specifications.

Install on a Solid, Level Mounting Pad

If conditions or local codes require the unit be attached to pad, tie down bolts should be used and fastened through knockouts provided in unit base pan. Refer to unit mounting pattern in Fig. 2 to determine base pan size and knockout hole location.

For hurricane tie downs, contact distributor for details and PE Certification (Professional Engineer), if required.

On rooftop applications, mount on level platform or frame. Place unit above a load–bearing wall and isolate unit and tubing set from structure. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Consult local codes governing rooftop applications.

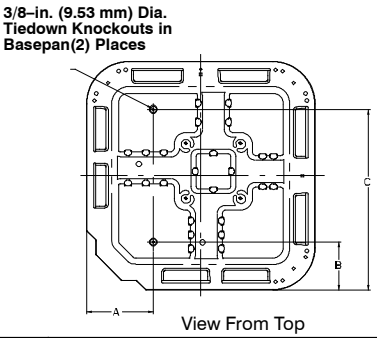
Roof mounted units exposed to winds above 5 mph may require wind baffles. Consult the Service Manual – Residential Split System Air Conditioners and Heat Pumps for wind baffle construction.

NOTE: Unit must be level to within ±2° (±3/8 in/ft,±9.5 mm/m) per compressor manufacturer specifications.

Clearance Requirements

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 24 in. (609.6 mm) clearance to service end of unit and 48 in. (1219.2 mm) (above unit. For proper airflow, a 6–in. (152.4 mm) clearance on 1 side of unit and 12–in. (304.8 mm) on all remaining sides must be maintained. Maintain a distance of 24 in. (609.6 mm) between units or 18 in. (457.2 mm) if no overhang within 12 ft. (3.66 m). Position so water, snow, or ice from roof or eaves cannot fall directly on unit.

NOTE: **18" (457.2 mm) clearance option described above is approved for outdoor units with wire grille coil guard only. Units with louver panels require 24" (609.6 mm) between units.** On rooftop applications, locate unit at least 6 in. above roof surface.



UNIT BASE PAN Dimension in. (mm)	TIEDOWN KNOCKOUT LOCATIONS in. (mm)		
	A	B	C
23 X 23 (585 X 585)	7–3/4 (196.8)	4–13/32 (111.9)	18–1/32 (457.9)
26 X 26 (660 X 660)	9–1/8 (231.8)	4–7/16 (112.7)	21–1/4 (539.8)
31–1/2 X 31–1/2 (800 X 800)	9–1/8 (231.8)	6–9/16 (166.7)	24–11/16 (627.1)
35 X 35 (889 X 889)	9–1/8 (231.8)	6–9/16 (166.7)	28–7/16 (722.3)

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Fig. 2 - Tiedown Knockout Locations

Operating Ambient

The minimum outdoor operating ambient in cooling mode without accessory is 55°F (12.78°C), and the maximum outdoor operating ambient in cooling mode is 125°F (51.67°C). The maximum outdoor operating ambient in heating mode is 66 °F (18.89°C).

Check Defrost Thermostat

Check defrost thermostat to ensure it is properly located and securely attached. There is a liquid header with a distributor and feeder tube going into outdoor coil. At the end of the one of the feeder tubes, there is a 3/8 in. O.D. stub tube approximately 2 in. (50.8 mm) long (see Fig. 3). The defrost thermostat should be located on stub tube. Note that there is only one stub tube used with liquid header, and on most units it is the bottom circuit.

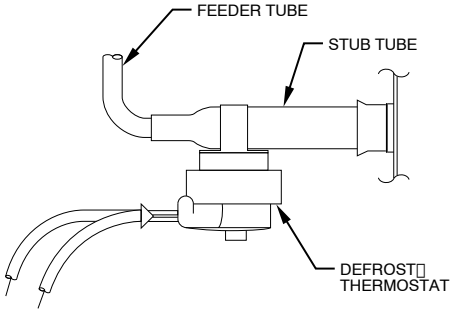

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Fig. 3 - Defrost Thermostat Location

Table 1 – Accessory Usage

Accessory	REQUIRED FOR LOW–AMBIENT COOLING APPLICATIONS (Below 55°F / 12.8°C)	REQUIRED FOR LONG LINE APPLICATIONS*	REQUIRED FOR SEA COAST APPLICATIONS (Within 2 miles / 3.22 km)
Accumulator	Standard	Standard	Standard
Ball Bearing Fan Motor	Yes†	No	No
Compressor Start Assist Capacitor and Relay	Yes	Yes	No
Crankcase Heater	Yes	Yes	No
Evaporator Freeze Thermostat	Yes	No	No
Hard Shutoff TXV	Yes	Yes	Yes
Isolation Relay	Yes	No	No
Liquid Line Solenoid Valve	No	See Long–Line Application Guideline	No
Motor Master® Control or Low Ambient Switch	Yes	No	No
Support Feet	Recommended	No	Recommended

* For tubing line sets between 80 and 200 ft. (24.38 and 60.96 m) and/or 20 ft. (6.09 m) vertical differential, refer to Residential Piping and Longline Guideline. .

† Additional requirement for Low–Ambient Controller (full modulation feature) MotorMaster® Control.

Make Piping Connections

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Use all service ports and open all flow–control devices, including solenoid valves.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

If ANY refrigerant tubing is buried, provide a 6–in (152.4 mm). vertical rise at service valve. Refrigerant tubing lengths up to 36–in (914.4 mm). may be buried without further special consideration. Do not bury lines longer than 36 in (914.4 mm).

Outdoor units may be connected to indoor section using accessory tubing package or field–supplied refrigerant grade tubing of correct size and condition. For tubing requirements beyond 80 ft, substantial capacity and performance losses can occur. Following the recommendations in the *Residential Piping and Long Line Guideline* will reduce these losses. Refer to Table 1 for accessory requirements. Refer to Table 2 for field tubing diameters.

There are no buried–line applications greater than 36 in. (914.4 mm)

If refrigerant tubes or indoor coil are exposed to atmosphere, they must be evacuated to 500 microns to eliminate contamination and moisture in the system.

Outdoor Unit Connected To Factory Approved Indoor Unit

Outdoor unit contains approximate system refrigerant charge for operation with approved AHRI rated indoor unit when connected by 15 ft (4.57 m) of field–supplied or factory–accessory tubing, and factory supplied filter drier. Some indoor units require additional subcooling to achieve optimal heating performance. Using Table 5 or 6– Additional Subcooling Required, check refrigerant charge for maximum efficiency

Refrigerant Tubing and Sweat Connections

Connect vapor tube to fitting on outdoor unit vapor service valves (see Table 2). Connect liquid tubing to adapter tube on liquid service valve. Use refrigerant grade tubing.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Service valves must be wrapped in a heat–sinking material such as a wet cloth while brazing.

Remove plastic retainer holding outdoor piston in liquid service valve, leaving the piston and piston retainer inside the valve. Connect sweat/flare adapter provided, to valve. (See Fig. 4.) Connect refrigerant tubing to fittings on outdoor unit vapor and liquid service valves. Service valves are closed from factory and ready for brazing. After wrapping service valve with a wet cloth, tubing set can be brazed to service valve using either silver bearing or non–silver bearing brazing material. Do not use soft solder (materials which melt below 800°F/427°C). Consult local code requirements. Refrigerant tubing and indoor coil are now ready for leak testing. This check should include all field and factory joints.

NOTE: Some outdoor units contain a mechanical fitting at the liquid distributor. This connection is not field serviceable and should not be disturbed.

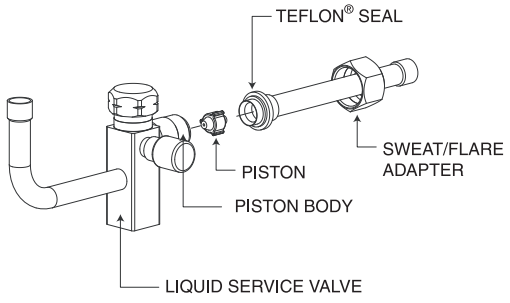

Fig. 4 - Liquid Service Valve

Table 2 – Refrigerant Connections and Recommended Liquid and Vapor Tube Diameters (In.)

UNIT SIZE	LIQUID		RATED VAPOR	
	Connection Diameter	Tube Diameter	Connection Diameter	Tube Diameter
18, 24	3/8	3/8	5/8	5/8
30, 36	3/8	3/8	3/4	3/4
42, 48	3/8	3/8	7/8	7/8
60	3/8	3/8	7/8	1–1/8

* Units are rated with 25 ft. (7.6 m) of lineset. See Product Data sheet for performance data when using different size and length linesets.

Notes:
1. Do not apply capillary tube indoor coils to these units.
2. For Tubing Set lengths between 80 and 200 ft. (24.38 and 60.96 m) horizontal or 20 ft. (6.09 m) vertical differential 250 ft. (76.2 m) Total Equivalent Length, refer to the Residential Piping and Longline Guideline – Air Conditioners and Heat Pumps using Puron refrigerant.

Installing with Indoor Piston

Outdoor Unit Connected to Factory Approved Indoor Unit

Check piston size shipped with indoor unit to see if it matches required indoor piston size. If it does not match, replace indoor piston with correct piston size.

NOTE: Correct pistons are shipped with outdoor units in the accessory bag and are only qualified for piston fan coils. Example fan coils with piston: FB4C and FY5B (1.5 through 4 ton)

When changing indoor piston, use a back – up wrench. Hand tighten hex nut, then tighten with wrench 1/2 turn. Do not exceed 30 ft – lbs. The indoor piston contains a Teflon ring (or seal) which is used to seat against the inside of distributor body, and must be installed properly to ensure proper seating. See Fig. 5.

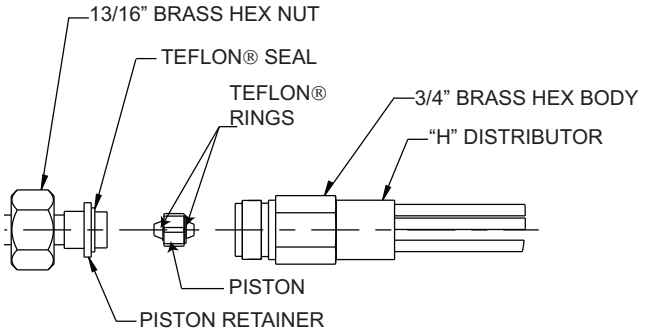

Fig. 5 - Indoor Piston Installation

Install Liquid Line Filter Drier Indoor

Refer to Fig. 6 and install filter drier as follows:

1. Braze 5 in. (127 mm) liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to 5 in. (127 mm) long liquid tube from step 1.
4. Connect and braze liquid refrigerant tube to the filter drier.

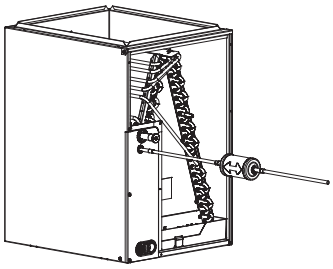

Fig. 6 - Liquid Line Filter Drier

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Installation of filter drier in liquid line is required.

Evacuate Refrigerant Tubing and Indoor Coil

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Never use the system compressor as a vacuum pump.

Refrigerant tubes and indoor coil should be evacuated using the recommended deep vacuum method of 500 microns. The alternate triple evacuation method may be used (see triple evacuation procedure in service manual). Always break a vacuum with dry nitrogen.

Deep Vacuum Method

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 microns and a vacuum gage capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and liquid water. A tight dry system will hold a vacuum of 1000 microns after approximately 7 minutes. (See Fig. 7.)

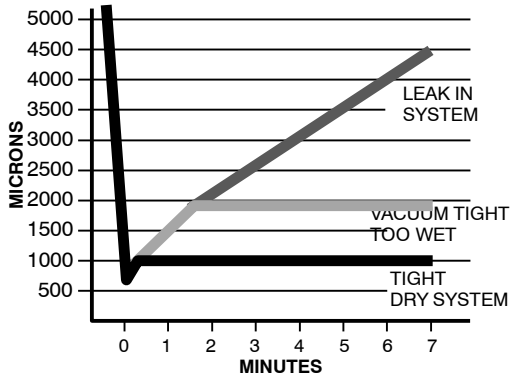

Fig. 7 - Deep Vacuum Graph

Final Tubing Check

IMPORTANT: Check to be certain factory tubing on both indoor and outdoor unit has not shifted during shipment. Ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to feeder tubes, makings sure wire ties on feeder tubes are secure and tight.

Be sure field wiring complies with local and national fire, safety, and electrical codes, and voltage to system is within limits shown on unit rating plate. Contact local power company for correction of improper voltage. See unit rating plate for recommended circuit protection device.

NOTE: Operation of unit on improper line voltage constitutes abuse and could affect unit reliability. See unit rating plate. Do not install unit in system where voltage may fluctuate above or below permissible limits.

Make Electrical Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Do not supply power to unit with compressor terminal box cover removed.

NOTE: Use copper wire only between disconnect switch and unit.

NOTE: Install branch circuit disconnect of adequate size per NEC to handle unit starting current. Locate disconnect within sight from and readily accessible from unit, per Section 440–14 of NEC.

Route Ground and Power Wires

Remove access panel to gain access to unit wiring. Extend wires from disconnect through power wiring hole provided and into unit control box.

Connect Ground and Power Wires

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

The unit cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes.

Connect ground wire to ground connection in control box for safety. Connect power wiring to contactor as shown in Fig. 8.

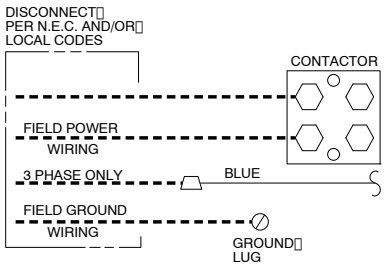

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Fig. 8 - Line Connections

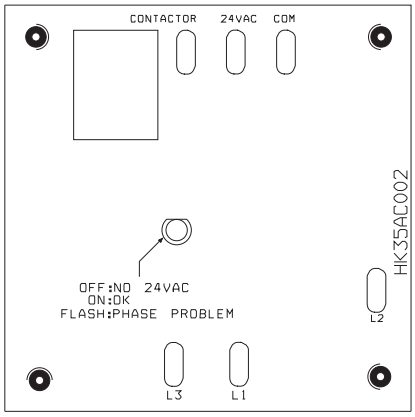

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Fig. 9 - 3–Phase Monitor Control (Applies to 3–Phase Units Only)

Table 3 – 3–Phase Monitor LED Indicators

LED	STATUS
OFF	No call for compressor operation
FLASHING	Reversed phase
ON	Normal

Connect Control Wiring

Route 24v control wires through control wiring grommet and connect leads to control wiring. See Thermostat Installation Instructions for wiring specific unit combinations. (See Fig. 10.)

Use No. 18 AWG color–coded, insulated (35°C minimum) wire. If thermostat is located more than 100 ft (30.5 m) from unit, as measured along the control voltage wires, use No. 16 AWG color–coded wire to avoid excessive voltage drop.

All wiring must be NEC Class 1 and must be separated from incoming power leads.

Use furnace transformer, fan coil transformer, or accessory transformer for control power, 24v/40va minimum.

NOTE: Use of available 24v accessories may exceed the minimum 40va power requirement. Determine total transformer loading and increase the transformer capacity or split the load with an accessory transformer as required.

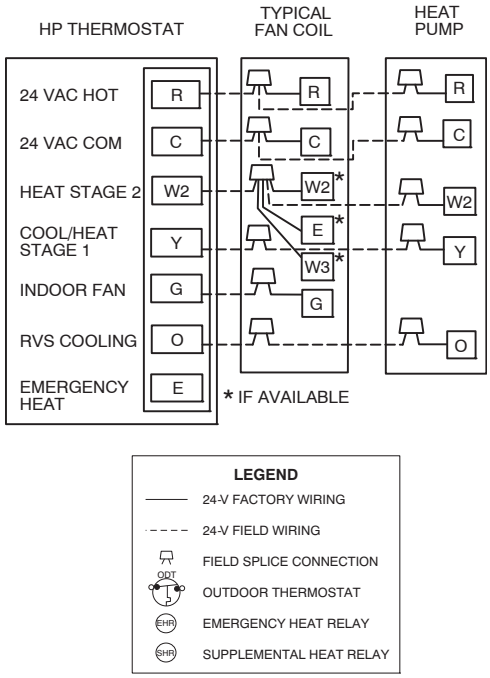

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Fig. 10 - Generic Wiring Diagrams (See thermostat Installation Instructions for specific unit combinations)

Final Wiring Check

IMPORTANT: Check factory wiring and field wire connections to ensure terminations are secured properly. Check wire routing to ensure wires are not in contact with tubing, sheet metal, etc.

Compressor Crankcase Heater

When equipped with a crankcase heater, furnish power to heater a minimum of 24 hr before starting unit. To furnish power to heater only, set thermostat to OFF and close electrical disconnect to outdoor unit.

A crankcase heater is required if refrigerant tubing is longer than 80 ft (23.4 m), or when outdoor unit is 20 ft (6.09 m) below indoor unit. Refer to the Residential Piping and Long Line Guideline.

Install Electrical Accessories

Refer to the individual instructions packaged with kits or accessories when installing.

Start–Up

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury.

Wear safety glasses, protective clothing, and gloves when handling refrigerant and observe the following:

• Front seating service valves are equipped with Schrader valves.

⚠ CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

Federal regulations require that you do not vent refrigerant to the atmosphere. Recover during system repair or final unit disposal.

⚠ CAUTION

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this caution may result in personal injury, equipment damage or improper operation.

• Do not overcharge system with refrigerant.

• Do not operate unit in a vacuum or at negative pressure.

• Do not disable low pressure switch in scroll compressor applications.

• Compressor dome temperatures may be hot.

Follow these steps to properly start up system:

1. After system is evacuated, fully open liquid and vapor service valves.
2. Unit is shipped with valve stem(s) front seated (closed) and caps installed. Replace stem caps after system is opened to refrigerant flow (back seated). Replace caps finger–tight and tighten with wrench an additional 1/12 turn.
3. Close electrical disconnects to energize system.
4. Set room thermostat at desired temperature. Be sure set point is below indoor ambient temperature.
5. Set room thermostat to HEAT or COOL and fan control to ON or AUTO mode, as desired. Operate unit for 15 minutes. Check system refrigerant charge.

Sequence of Operation

Turn on power to indoor and outdoor units. Transformer is energized.

Cooling

On a call for cooling, thermostat makes circuits R–O and R–Y, and R–G. Circuit R–O energizes reversing valve, switching it to cooling position. Circuit R–Y energizes contactor, starting outdoor fan motor and compressor circuit. R–G energizes indoor unit blower relay, starting indoor blower motor on high speed.

When thermostat is satisfied, its contacts open, de–energizing contactor and blower relay. Compressor and motors should stop.

NOTE: If indoor unit is equipped with a time–delay relay circuit, the indoor blower will run an additional 90 seconds to increase system efficiency.

Heating

On a call for heating, thermostat makes circuits R–Y and R–G. Circuit R–Y energizes contactor, starting outdoor fan motor and compressor. Circuit R–G energizes indoor blower relay, starting blower motor on high speed.

Should temperature continue to fall, R–W2 is made through second–stage room thermostat. Circuit R–W2 energizes a relay, bringing on first bank of supplemental electric heat and providing electrical potential to second heater relay (if used). If outdoor temperature falls below setting of outdoor thermostat (field installed option), contacts close to complete circuit and bring on second bank of supplemental electric heat.

When thermostat is satisfied, its contacts open, de–energizing contactor and relay. All heaters and motors should stop.

Defrost

The defrost control is a time/temperature control which includes a field selectable (quick–connects located at board edge) time period between defrost cycles (30, 60, or 90 minutes), factory set to either 60 or 90 minutes.

The electronic defrost timer sequence is enabled when the T1 input on the board is energized. The timer starts only when the defrost thermostat is closed and the contactor is energized.

Defrost mode is identical to cooling mode except that outdoor fan motor stops and second–stage heat is turned on to continue warming conditioned spaces.

To initiate defrost, the defrost thermostat must be closed. This can be accomplished as follows:

1. Turn off power to outdoor unit.
2. Disconnect outdoor fan motor lead from OF2 on control board (see Fig. 11). Tape lead to prevent grounding.
3. Restart unit in heating mode, allowing frost to accumulate on outdoor coil.
4. After a few minutes in heating mode, liquid line temperature should drop below closing point of defrost thermostat (approximately 30°F/–1.11°C).
5. Short between speedup terminals with a flat–blade screwdriver. This reduces the timing sequence to 1/25th of original time. (See Table 4.)
6. When you hear reversing valve change position, remove screwdriver immediately; otherwise, control will terminate normal 10–minute defrost cycle in approximately 2 seconds.

NOTE: Length of defrost cycle is dependent upon length of time it takes to remove screwdriver from test pins after reversing valve has shifted.

7. Unit will remain in defrost for remainder of defrost cycle time or until defrost thermostat reopens at approximately 65°F (18.33°C) coil temperature of liquid line.
8. Turn off power to outdoor unit and reconnect fan motor lead to OF2 on control board.

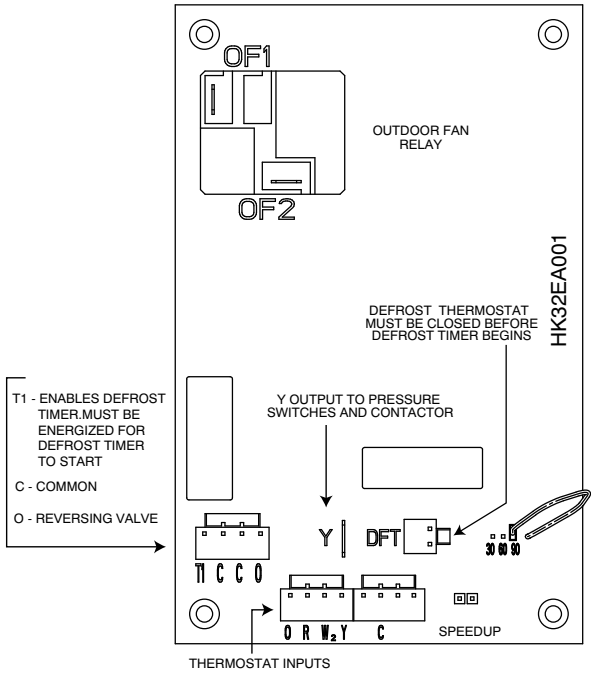

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Fig. 11 - Defrost Control

Table 4 – Defrost Control Speedup–Timing Sequence

PARAMETER	MINIMUM (MINUTES)	MAXIMUM (MINUTES)	SPEEDUP (NOMINAL)
30–minute cycle	27	33	7 sec
50–minute cycle	45	55	12 sec
90–minute cycle	81	99	21 sec
10–minute cycle	9	11	2 sec
5 minutes	4.5	5.5	1 sec

Check Charge

Factory charge amount and desired subcooling are shown on unit rating plate. Additional subcooling may be required to achieve optimal heating performance based on the installed indoor unit. (see Table 5 or 6).

Charging method is shown on information plate inside unit. For TXV, use subcooling method. For piston, use superheat method. To properly check or adjust charge, conditions must be favorable for subcooling or superheat charging. Favorable conditions exist when the outdoor temperature is between 70°F and 100°F (21.11°C and 37.78°C), and the indoor temperature is between 70°F and 80°F (21.11°C and 26.67°C). Follow the procedure below:

Unit is factory charged for 15ft (4.57 m) of lineset. Adjust charge by adding or removing 0.6 oz/ft (.018 kg/m) of 3/8 liquid line above or below 15ft (4.57 m) respectively.

For standard refrigerant line lengths (80 ft/24.38 m or less), allow system to operate in cooling mode at least 15 minutes. If conditions are favorable, check system charge by super heat method for fixed metering device and subcooling method for TXV. If any adjustment is necessary, adjust charge slowly and allow system to operate for 15 minutes to stabilize before declaring a properly charged system. Refer to Table 5 or 6 for additional subcooling required.

If the indoor temperature is above 80°F (26.67°C), and the outdoor temperature is in the favorable range, adjust system charge by weight based on line length and allow the indoor temperature to drop to 80°F (26.67°C) before attempting to check system charge by subcooling method as described above.

If the indoor temperature is below 70°F (21.11°C), or the outdoor temperature is not in the favorable range, adjust charge for line set length above or below 15ft (4.57 m) only. Charge level should then be appropriate for the system to achieve rated capacity. The charge level could then be checked at another time when the both indoor and outdoor temperatures are in a more favorable range.

NOTE: If line length is beyond 80 ft (24.38 m) or greater than 20 ft (6.10 m) vertical separation, See Residential Piping and Long Line Guideline for special charging requirements.

Units with Cooling Mode TXV

Units installed with cooling mode TXV require charging by the subcooling method.

1. Operate unit a minimum of 10 minutes before checking charge.
2. Measure liquid service valve pressure by attaching an accurate gage to service port.
3. Measure liquid line temperature by attaching an accurate thermistor type or electronic thermometer to liquid line near outdoor coil.
4. Refer to unit rating plate for required subcooling temperature.
5. Refer to Table 7. Find the point where required subcooling temperature intersects measured liquid service valve pressure.
6. To obtain required subcooling temperature at a specific liquid line pressure, add refrigerant if liquid line temperature is higher than indicated or reclaim refrigerant if temperature is lower. Allow a tolerance of ±3°F.

Units with Indoor Pistons

Units installed with indoor pistons require charging by the superheat method.

The following procedure is valid when indoor airflow is within ±21 percent of its rated CFM.

1. Operate unit a minimum of 10 minutes before checking charge.
2. Measure suction pressure by attaching an accurate gage to suction valve service port.
3. Measure suction temperature by attaching an accurate thermistor type or electronic thermometer to suction line at service valve.
4. Measure outdoor air dry–bulb temperature with thermometer.
5. Measure indoor air (entering indoor coil) wet–bulb temperature with a sling psychrometer.
6. Refer to Table 8. Find outdoor temperature and evaporator entering air wet–bulb temperature. At this intersection, note superheat. Where a dash (—) appears on the table, do not attempt to charge system under these conditions or refrigerant slugging may occur. Charge must be weighted in, adding or removing 0.6 oz/ft of 3/8 liquid line above or below 15 ft (4.57 m) respectively.
7. Refer to Table 9. Find superheat temperature located in item 6 and suction pressure. At this intersection, note suction line temperature.
8. If unit has a higher suction line temperature than charted temperature, add refrigerant until charted temperature is reached.
9. If unit has a lower suction line temperature than charted temperature, reclaim refrigerant until charted temperature is reached.
10. When adding refrigerant, charge in liquid form into suction service port using a flow–restricting device.
11. If outdoor air temperature or pressure at suction valve changes, charge to new suction line temperature indicated on chart.
12. Optimum performance will be achieved when the operating charge produces 5° to 6°F suction superheat at suction service valve with 82°F outdoor ambient and 80°F (26.7°C) dry bulb (67°F / 19.4°C) wet bulb) indoor temperature (DOE “B” test conditions) at rated airflow.

Heating Check Chart Procedure

To check system operation during heating cycle, refer to the Heating Check Chart on outdoor unit. This chart indicates whether a correct relationship exists between system operating pressure and air temperature entering indoor and outdoor units. If pressure and temperature do not match on chart, system refrigerant charge may not be correct. Do not use chart to adjust refrigerant charge.

Table 5 – Additional Subcooling Required – 13 & 14 SEER Units

Indoor Unit	Subcooling Delta from Rating Plate Value						
	Outdoor Unit Tonnage						
	018	024	030	036	042	048	060
CAP**1814A**	—						
CNPV*1814A**	—						
FB4CNF018+TXV	—						
FF1ENP(018/019)	—						
FX4DNF019	+3						
CAP**24**A**	+3	+3					
CNP**24**A**	+3	+3					
CSPH*2412A**	+5	+5					
FB4CNF024+TXV	—	—					
FF1ENP(024/025)	+5	+3					
(FV4C/FE4A)NF002	+5	+3	+3				
FX4DNF025	+5	+3					
CAP**30**A**		+3	—				
CNP**30**A**		+3	+3				
CSPH*3012A**		+3	+3				
FB4CNF030+TXV		+3	—				
FF1ENP030		+3	—				
FF1ENP031		+3	—				
FX4DN(B,F)031		+5	+5				
CAP**36**A**			+5	+3			
CNP**36**A**			+3	—			
CSPH*3612A**			+5	+3			
FB4CNF036+TXV			—	—			
(FV4C/FE4A)N(B,F)003		+5	+5	+3	—		
FF1ENP036			+5	+3			
FF1ENP037			+5	+3			
FX4DN(B,F)037			+5	+5			
CAP**42**A**				+3	—		
CNP**4221A**				+3	—		
CNPV*4217A**				+3	—		
CSPH*4212A**				+5	—		
FB4CNF042+TXV				+5	—		
FX4DN(B,F)043				+5	—		
CAP**4817A**					+5	+3	
CAP**48(21,24)A**					+3	—	
CNP**48**A**					—	—	
CSPH*4812A**					+3	—	
FB4CNF048+TXV					—	—	
(FV4C/FE4A)N(B,F)005			+5	+5	+3	—	—
FX4DN(B,F)049					+3	—	
CAP**60**A**						+5	+3
CNP**6024A**						+3	—
CSPH*6012A**						+5	+3
FB4CNF060						+5	—
(FV4C/FE4A)NB006				+5	+5	+5	+3
FX4DN(B,F)061						+5	+3

Table 6 – Additional Subcooling Required – 15 SEER Units

Indoor Unit	Subcooling Delta from Rating Plate Value						
	OUTDOOR UNIT TONNAGE						
	018	024	030	036	042	048	060
CAP**1814A**	—						
CNPV*1814A**	—						
FB4CNF018+TXV	—						
FF1ENP(018/019)	—						
FX4DNF019	—						
CAP**24**A**	—	—					
CNP**24**A**	—	—					
CSPH*2412A**	—	—					
FB4CNF024+TXV	—	—					
FF1ENP(024/025)	—	—					
(FV4C/FE4A)NF002	+3	—	—				
FX4DNF025	—	—					
CAP**30**A**		—	—				
CNP**30**A**		—	—				
CSPH*3012A**		—	—				
FB4CNF030+TXV		—	—				
FF1ENP030		—	—				
FF1ENP031		—	—				
FX4DN(B,F)031		+3	—				
CAP**36**A**			—	—			
CNP**36**A**			—	—			
CSPH*3612A**			—	—			
FB4CNF036+TXV			—	—			
(FV4C/FE4A)N(B,F)003		—	—	—	—		
FF1ENP036			—	—			
FF1ENP037			—	—			
FX4DN(B,F)037			+5	—			
CAP**42**A**				—	—		
CNP**4221A**				—	—		
CNPV*4217A**				—	—		
CSPH*4212A**				—	—		
FB4CNF042+TXV				—	—		
FX4DN(B,F)043				—	—		
CAP**4817A**					+5	—	
CAP**48(21,24)A**					+3	—	
CNP**48**A**					—	—	
CSPH*4812A**					—	—	
FB4CNF048+TXV					—	—	
(FV4C/FE4A)N(B,F)005			+3	+3	+3	—	—
FX4DN(B,F)049					+3	—	
CAP**60**A**						+5	—
CNP**6024A**						—	—
CSPH*6012A**						+3	—
FB4CNF060						—	—
(FV4C/FE4A)NB006				+5	+5	+3	—
FX4DN(B,F)061						+3	—

Table 7 – Required Liquid Line Temperatures °F

LIQUID PRESSURE AT SERVICE VALVE (PSIG)	REQUIRED SUBCOOLING TEMPERATURE (° F)					
	8	10	12	14	16	18
251	76	74	72	70	68	66
259	78	76	74	72	70	68
266	80	78	76	74	72	70
274	82	80	78	76	74	72
283	84	82	80	78	76	74
291	86	84	82	80	78	76
299	88	86	84	82	80	78
308	90	88	86	84	82	80
317	92	90	88	86	84	82
326	94	92	90	88	86	84
335	96	94	92	90	88	86
345	98	96	94	92	90	88
354	100	98	96	94	92	90
364	102	100	98	96	94	92
374	104	102	100	98	96	94
384	106	104	102	100	98	96
395	108	106	104	102	100	98
406	110	108	106	104	102	100
416	112	110	108	106	104	102
427	114	112	110	108	106	104
439	116	114	112	110	108	106
450	118	116	114	112	110	108
462	120	118	116	114	112	110
474	122	120	118	116	114	112
486	124	122	120	118	116	114
499	126	124	122	120	118	116
511	128	126	124	122	120	118

Table 8 – Superheat Charging (Heat Pump Only)

OUTDOOR TEMP (° F)	EVAPORATOR ENTERING AIR TEMPERATURE (° F WB)													
	50	52	54	56	58	60	62	64	67	68	70	72	74	76
55	11	11	12	12	12	13	17	20	24	24	25	25	25	25
60	6	6	7	7	7	7	12	16	21	22	23	23	23	23
65	–	–	–	–	–	3	7	12	18	19	21	21	22	22
70	–	–	–	–	–	–	–	7	14	16	18	20	20	20
75	–	–	–	–	–	–	–	3	11	13	16	18	18	19
82	–	–	–	–	–	–	–	–	***6**	8	12	15	16	17
85	–	–	–	–	–	–	–	–	4	7	11	14	15	16
90	–	–	–	–	–	–	–	–	–	4	8	12	14	15
95	–	–	–	–	–	–	–	–	–	–	6	10	12	14
100	–	–	–	–	–	–	–	–	–	–	4	8	11	12
105	–	–	–	–	–	–	–	–	–	–	3	6	9	11
110	–	–	–	–	–	–	–	–	–	–	–	5	7	10
115	–	–	–	–	–	–	–	–	–	–	–	3	6	8

*Optimum performance point, 82° F outdoor ambient and (80° F dry bulb),(67° F wet bulb) indoor conditions. (DOE B Test Conditions)
Where a dash (—) appears do not attempt to charge system under these conditions or refrigerant slugging may occur. Charge must be weighed in.
Note: Superheat ° F is at low–side service port, Allow a tolerance of ± 3° F
Note: Indoor dry bulb between 70° F and 80° F

Table 9 – Required Suction–Line Temperature

SUPERHEAT TEMP (° F)	SUCTION PRESSURE AT SERVICE PORT (PSIG)								
	107.8	112.2	116.8	121.2	126	130.8	138.8	140.8	145.8
0	35	37	39	41	43	45	47	49	51
2	37	39	41	43	45	47	49	51	53
4	39	41	43	45	47	49	51	53	55
6	41	43	45	47	49	51	53	55	57
8	43	45	47	49	51	53	55	57	59
10	45	47	49	51	53	55	57	59	61
12	47	49	51	53	55	57	59	61	63
14	49	51	53	55	57	59	61	63	65
16	51	53	55	57	59	61	63	65	67
18	53	55	57	59	61	63	65	67	69
20	55	57	59	61	63	65	67	69	71
22	57	59	61	63	65	67	69	71	73
24	59	61	63	65	67	69	71	73	75
26	61	63	65	67	69	71	73	75	77
28	63	65	67	69	71	73	75	77	79
30	65	67	69	71	73	75	77	79	81

FINAL CHECKS

IMPORTANT: Before leaving job, be sure to do the following:

1. Ensure that all wiring is routed away from tubing and sheet metal edges to prevent rub–through or wire pinching.
2. Ensure that all wiring and tubing is secure in unit before adding panels and covers. Securely fasten all panels and covers.
3. Tighten service valve stem caps to 1/12–turn past finger tight.
4. Leave Owner's Manual with owner. Explain system operation and periodic maintenance requirements outlined in manual.
5. Fill out Dealer Installation Checklist and place in customer file.

CARE AND MAINTENANCE

For continuing high performance and to minimize possible equipment failure, periodic maintenance must be performed on this equipment.

Frequency of maintenance may vary depending upon geographic areas, such as coastal applications. See Users Manual for information.

PURON® (R–410A) QUICK REFERENCE GUIDE

- Puron refrigerant operates at 50–70 percent higher pressures than R–22. Be sure that servicing equipment and replacement components are designed to operate with Puron
- Puron refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- Puron systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low–side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- Puron, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid–line filter driers with rated working pressures less than 600 psig.
- Do not leave Puron suction line filter driers in line longer than 72 hours.
- Do not install a suction–line filter drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory approved liquid–line filter drier is required on every unit.
- Do NOT use an R–22 TXV.
- If indoor unit is equipped with an R–22 TXV or piston metering device sized for R–22 application, it must be changed to a hard shutoff Puron TXV or properly sized Puron piston metering device.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent Puron into the atmosphere.
- Do not use capillary tube coils.
- Observe all **warnings**, **cautions**, and **bold** text.

Edition Date: 06/13

Catalog No: 25HBB–C–HCD–03SI

Replaces: 25HBB–C–HCD–02SI

Bardi
24/7 Heating & Air Conditioning
The Climate's Always Right With Bardi

Section #2

Fan Coil Unit

Carrier

FB4, FE4, FF1E,
FH4, FV4, FX4,
PF4, FFM

Residential Fan Coil Units

Service and Maintenance Instructions

NOTE: Read the entire instruction manual before starting the installation.

TABLE OF CONTENTS

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing and work gloves. Have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and the current editions of the National Electrical Code (NEC) NFPA 70.

In Canada, refer to the current editions of the Canadian Electrical Code CSA C22.1.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instruction manuals, be alert to the potential for personal injury.

Understand the signal words **DANGER**, **WARNING**, and **CAUTION**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which **will** result in severe personal injury or death. **WARNING** signifies hazards which **could** result in personal injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

⚠ WARNING

UNIT OPERATION AND SAFERTY HAZARD

Failure to follow this warning could result in personal injury or death.

Puron (R-410A) systems operate at higher pressures than R-22 systems. Do not use R-22 service equipment or components on R-410 equipment. Ensure service equipment is rated for R-410.

INTRODUCTION

The “F” and “PF” series fan coil units are designed for flexibility in a variety of applications that meet upflow, horizontal, or downflow requirements. Units are available in 1-1/2 through 5 ton nominal cooling capacities. Factory-authorized, field-installed electric heater packages are available in 3 through 30 kilowatts.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing unit, always turn off all power to unit. There may be more than one disconnect switch. Turn off accessory heater power if applicable. Lock out and tag switch with a suitable warning label.

FAN COIL DESCRIPTION AND TROUBLESHOOTING

FY5, FH4, PF4 (even sizes) and FF1E (even sizes),

FAN MOTOR

The motor is two or three speed direct drive. High-speed lead is black, low-speed lead is red, and common lead is yellow. Be sure proper blower speed has been selected..

The motor is turned on through two different routes. The first occurs when thermostat calls for the fan in cooling, heat pump, or fan-only mode. A 24-Vac signal is sent to relay, causing relay to close its normally open contacts, turning fan on.

The second occurs when there is a call for electric heat. A 24-Vac signal is sent to heater sequencer/relay, causing it to close, directing 230V through the normally closed contact of fan relay, turning fan on. The fan remains on until sequencer/relay opens.

If motor does run, test motor for an open winding or a winding shorted to motor case. If either is present, replace motor.

ELECTRIC HEATER SERVICE

Service can be completed with heater in place. Shut off power before servicing.

A. Limit Switch

Refer to Electric Heater Function and Troubleshooting section of this manual.

B. Sequencer

Refer to Electric Heater Function and Troubleshooting section of this manual.

C. Transformer

A 40-VA transformer supplies 24-V power for control circuit. Check for 208/230V on primary side of transformer. If present, check for 24V on secondary side.

NOTE: Transformer is fused. Do not short circuit.

D. Fan Relay

Relay coil is 24-V. Check for proper control voltage. Replace relay if faulty.

CLEANING OR REPLACING REFRIGERANT FLOW-CONTROL DEVICE

Refer to Fig. 21 and instructions given in "Piston Body Cleaning or Replacement" section.

The refrigerant flow-control device is protected by a wire mesh strainer. It is located inside the 3/8-in. liquid tube at field braze joint next to flow-control device. Access to strainer is through field braze joint.

SEQUENCE OF OPERATION

A. Condensing Unit

COOLING

When thermostat calls for cooling, the circuit between R and G is complete and single-pole single-throw relay FR is energized. The normally open contacts close causing blower to operate.

The circuit between R and Y is also complete. This completed circuit causes contactor in outdoor unit to close which starts compressor and outdoor fan.

HEATING

When thermostat calls for heating and FAN switch is set on AUTO, the circuit between R and W is complete. The heater sequence SEQ is energized which closes contacts of relay. There will be a time delay. This completed circuit energizes all heating elements HTR and blower motor.

B. Heat Pump

COOLING

On a call for cooling, the thermostat makes circuits R-O, R-Y, and R-G. Circuit R-O energizes reversing valve, switching it to cooling position. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor unit blower relay starting indoor blower motor.

When thermostat is satisfied, its contacts open de-energizing contactor reversing valve and blower relay. This stops compressor and fan motors.

HEATING

On a call for heating, the thermostat makes circuits R-Y and R-G. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor blower relay starting blower motor.

Should temperature continue to fall, R-W circuit is made through second-stage room thermostat bulb. Circuit R-W energizes a sequencer bringing on supplemental electric heat.

When thermostat is satisfied, its contacts open de-energizing contactor and sequencer. All heaters and motors should stop.

CES013003-00, 01 (HK61EA002, HK61EA006) CONTROL BOARDS

This section of the service manual describes the CESO130003-00 and -01 PCB by examining the functional operation of the PCB components.

Printed Circuit Board (PCB) Component

Layout of the actual PCB is depicted in Fig. 1 and Fig. 2.

1. The low-voltage stripped leads are used to connect the 24-V side of transformer to indoor thermostat and outdoor section.
2. A 5-amp fuse is used to protect the low-voltage transformer secondary.
3. The fan relay is controlled by thermostat and turns fan on and off.
4. A plug is used as the connection for PCB power and electric heaters. Note the pin numbers on plug.
5. A time-delay relay circuit keeps fan motor running for approximately 90 seconds after G is de-energized. The time-delay can be defeated by cutting jumper JW1 on the CES0130003-01, HK61EA002 and HK61EA006.

UNIT FUNCTIONS

A. Transformer

1. Proper Wiring of Transformer Primary or High Side
   Yellow wire from Molex plug is wired to C terminal on transformer and black wire from PCB relay (normally-open) terminal is wired to 208-V or 230-V terminal on transformer. Units are factory wired at 230-V terminal.
2. Proper Wiring of Transformer Secondary or 24-V Side
   Red wire of transformer is wired to T terminal on PCB and brown wire of transformer is wired to C terminal on PCB.

NOTE: T terminal on PCB is used to protect the transformer. T terminal is connected through the fuse to R terminal on PCB.

B. Indoor Fan

1. Wiring
   Indoor fan motor yellow lead is wired to C terminal on transformer. The red, blue, or black speed lead is wired to SPT terminal on fan relay part of PCB. Units are factory wired on medium speed (blue lead connected).

NOTE: Unused fan speed leads must be capped or taped off to prevent direct short to cabinet surface.

2. Functional Control
   a. Thermostat and Relay Control
      When thermostat calls for the fan in cooling, heat pump, heating, or fan-only mode, a 24-Vac signal is sent to relay. This causes the relay to close its normally-open contacts, turning on fan. When thermostat no longer calls for the fan,

the signal sent to relay is turned off and relay opens causing fan to turn off after a 90-second fan-off delay.

b. Sequencer/Electric Heat Relay Interlock
The fan will also operate whenever there is a call for electric heat, even if fan relay is not energized. This happens because fan is interlocked with first stage of electric heat through the normally-closed contact of fan relay.

NOTE: The fan interlock is only connected to first stage electric heat (W2). W3 and E do not contain an interlock with fan. See outdoor thermostat installation instructions when electric heat staging is desired.

C. Electric Heat

When thermostat calls for electric heat, a 24-Vac signal is sent to sequencer/heat relay through W2, causing first stage to turn on. W3 and E also receive signal if wired in with W2. If W3 and E are not wired to W2, the sequencers/heat relays can be controlled individually to stage additional electric heat. The sequence control is described in the following section:

1. W2
When thermostat sends a signal to W2, a 24-Vac signal is applied across sequencer/relay No. 1, causing it to close. When sequencer/relay No. 1 closes, first stage of electric heat is energized. In straight electric heat, fan is also energized through the normally closed contacts of fan relay. In cooling, heat pump, or manual fan mode, fan will already be running since fan relay would have been energized. When thermostat stops calling for electric heat, the 24-Vac signal to sequencer/relay No. 1 turns off and sequencer opens after a delay of 60 to 90 seconds. Heaters equipped with relays will be de-energized immediately. When sequencer/relay opens, first stage of heat turns off along with fan, providing thermostat is not calling for the fan.
2. W3
When a signal is sent to W3, a 24-Vac signal to sequencer/relay No. 2 causes it to close, with second stage of electric heat turning on. The 24-Vac signal applied to sequencer/relay No. 1 causes fan to operate. Timing is such that sequencer/relay No. 1 will turn on before sequencer/relay No. 2. When signal to W3 is turned off, sequencer/relay No. 2 opens. If W2 is also satisfied, first stage of electric heat and fan will also turn off, providing thermostat is not calling for the fan.
3. E
When thermostat sends a signal to E, a 24-Vac signal is sent to sequencer/relay No. 3. The 24-Vac signal applied to sequencer/relay No. 3 turns on third stage of electric heat. The 24-Vac signal applied to sequencer/relay No. 1 turns on first stage of electric heat and fan. When thermostat stops calling for electric heat, the signal to sequencers/relays 1, 2, and 3 are turned off, and sequencers/relays open. This causes electric heat to turn off with fan, providing thermostat is not calling for the fan.

NOTE: Electric heaters are factory wired with all stages tied together. If independent staging is desired, consult outdoor thermostat installation instructions, or corporate thermostat instructions.

TROUBLESHOOTING THE PRINTED CIRCUIT BOARD (CES013000-00, 01 / HK61EA002 / HK61EA006)

Use wiring schematics shown in Fig. 1, and Fig. 2 as a guide in troubleshooting PCB unless otherwise noted.

A. If Fan Will Not Turn On from Thermostat:

IF THERE IS NO HIGH VOLTAGE TO TRANSFORMER:

1. Check plug/receptacle connection. This supplies power from heaters to PCB Fan Relay. Be sure plug is connected properly.
2. Check sequencer/relay No. 1 and plug wiring. Yellow wire should be connected to Pin No. 9 of plug and to limit switch. Black wire should be connected to Pin No. 7 of plug and to sequencer/relay No. 1.
3. Check field power leads L1 and L2. If these are not receiving power, system cannot function.

IF TRANSFORMER HAS HIGH VOLTAGE APPLIED TO IT:

1. Check low-voltage transformer leads R (red) and C (brown). Be sure they are wired to correct locations.
2. Check output voltage of transformer secondary side R (red) and C (brown). Be sure transformer output is between 18Vac and 30Vac. If transformer output is incorrect and transformer is receiving correct input voltage (208V or 230V), then transformer needs to be replaced with recommended transformer. If no problem exists with transformer secondary, proceed to items 3 and 4.
3. Check low-voltage fuse shown in Fig. 1 or Fig. 2. If fuse is blown, replace it with an identical 5-amp fuse. The transformer cannot supply power to board with fuse blown or loose. If fuse blows when unit has power applied to it, the system most likely has one of the following problems:
   a. Check all 24-V wiring for an electrical short.
   b. The maximum load on transformer is 40 VA. If load on transformer is excessive, the low-voltage 5-amp fuse will blow to protect transformer. If load exceeds VA rating of transformer, a larger VA rated transformer needs to be installed. Check sequencers/relays for excessive current draw.
   c. Check wiring of heaters. If a heater is miswired, fuse may blow. If a heater is miswired, correct miswiring by comparing it to heater wiring label.
4. Check connections on primary side of transformer. If they are not connected properly, the transformer secondary cannot supply the 24-V signal to energize fan relay. If transformer is receiving correct primary voltage but is not putting out correct secondary voltage, transformer needs to be replaced.

B. If Electric Heat Stages Will Not Turn On But Fan Will Turn On:

IF THERE IS NO HIGH VOLTAGE TO TRANSFORMER:

1. Check plug connection between heaters and board. This supplies power to transformer and fan. Be sure plug is connected properly.
2. Check sequencer/relay No. 1 and plug wiring. Yellow wire should be connected to Pin No. 9 of plug and to limit switch. Black wire should be connected to Pin No. 7 of plug and to sequencer/relay No. 1.
3. Check incoming high-voltage power leads. If these are not receiving power, system cannot function.

IF TRANSFORMER HAS VOLTAGE APPLIED TO IT:

1. Check low-voltage transformer leads R (red) and C (brown). Make sure they are wired to correct location. The unit will not function without proper connections.
2. Check output voltage of transformer secondary side R (red) and C (brown). If transformer output is low (less than 18Vac), refer to items 3 and 4 of previous "If Transformer Has High Voltage Applied To It" section.

IF TRACES ARE OVERHEATED ON BACK OF PCB:

Usually whenever a trace is blown on PCB, it means either there has been a high-voltage short or high voltage has been applied to low-voltage circuit. This can be prevented by making sure PCB is wired correctly before PCB has power applied to it.

C. If Transformer Fuse Keeps Blowing:

When low-voltage fuse blows, it means transformer would have blown if fuse had not been in circuit to protect it. The fuse usually

blows when there is a high current draw on transformer, high voltage applied to low-voltage circuit, or a direct secondary short. When there is a high current draw on transformer, it is most likely because transformer has been shorted or system is trying to draw more VA than transformer rating allows. When fuse blows because of high voltage, the system has mixed high- and low-voltage signals.

1. Check wiring of sequencers/relays as shown in Fig. 1 and Fig. 2. Be sure transformer is not shorting out because thermostat wires are miswired.
2. Check wiring of relays as shown in Fig. 1 And Fig. 2. Be sure low-voltage and high-voltage wiring is correct.
3. Check VA draw on transformer. If VA draw is more than VA rating of transformer, fuse will blow. If this is the case, replace transformer with one that has a higher VA rating and meets system specifications.

D. If Fan Runs Continuously:

1. If PCB has no low-voltage power, check blue and black fan leads. These may be switched at sequencer/relay.
2. If PCB has low-voltage power, check fan relay to see if it is opening and closing. It may be stuck in the normally closed position due to debris in relay.

E. Transformer Failure:

Check 208-V and 230-V transformer connections. They may be miswired.

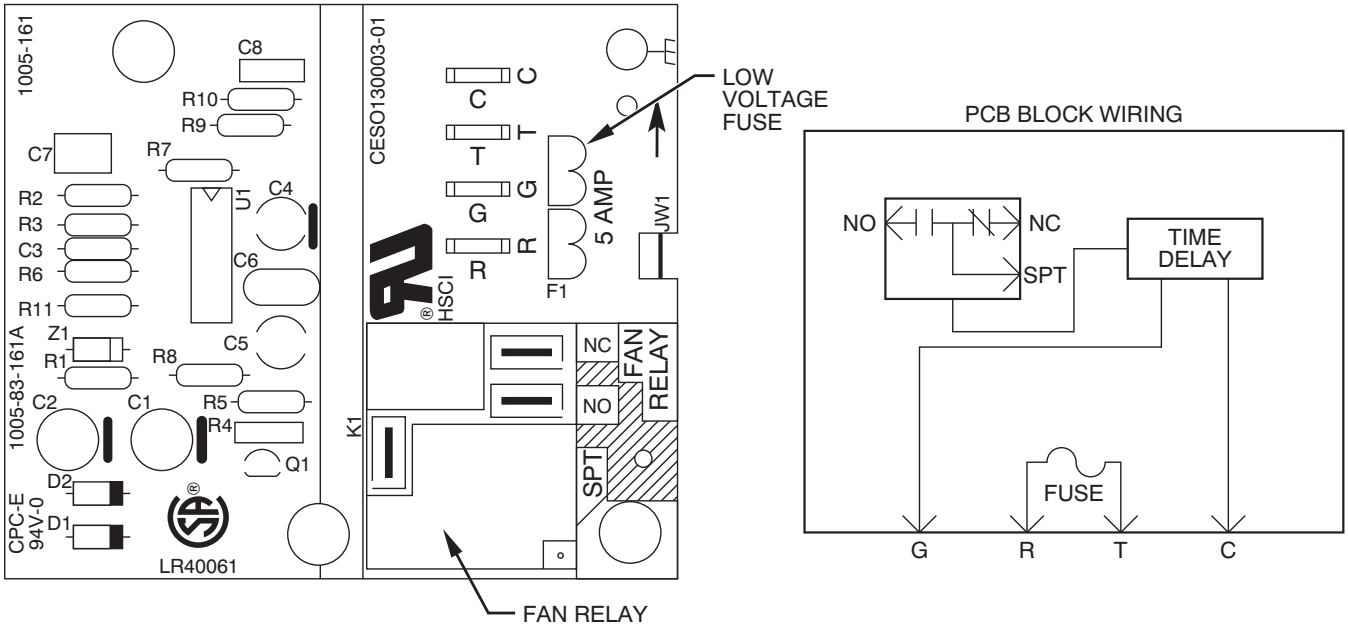

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Fig. 1 - Fan Coil Printed Circuit Board (CES013003-00, 01 / HK61EA002)

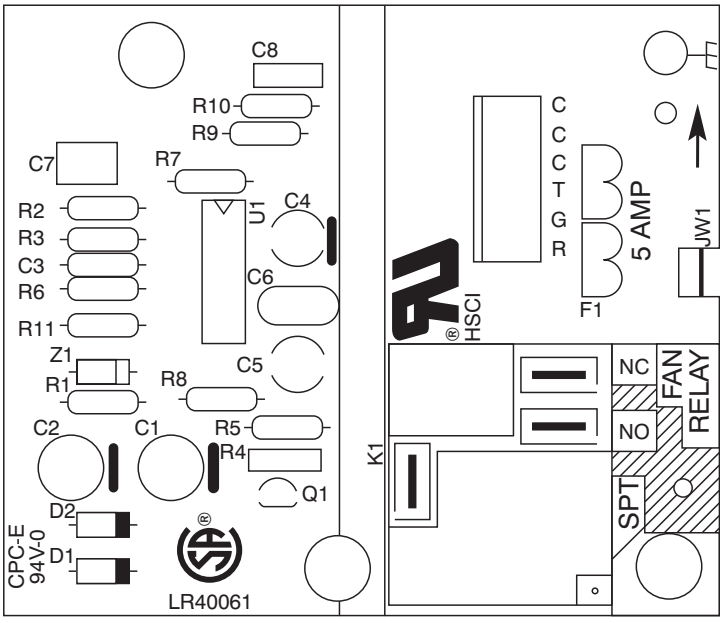

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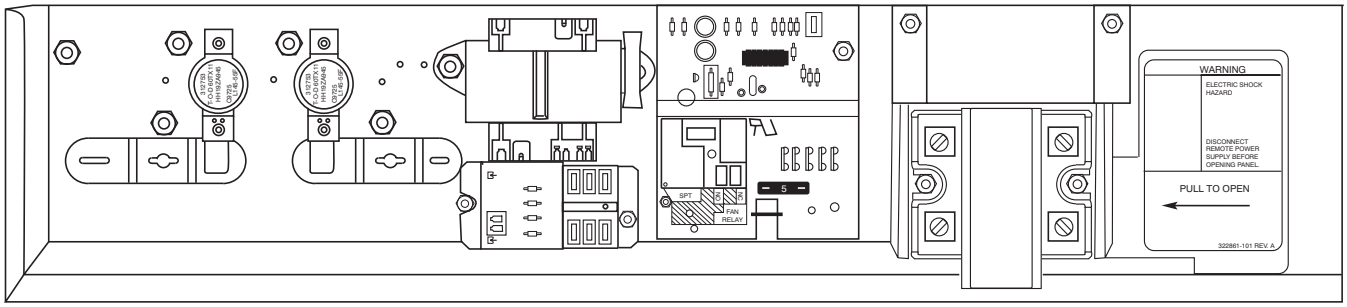
Fig. 2 - Fan Coil Printed Circuit Board (HK61EA006)



FF1E CONTROL BOX

A13032

Fig. 3 - Electric Heater Control Box

FB4C, FX4D, PF4 (odd sizes) and FF1E (odd sizes)

FAN MOTOR

The X-13 motor used with this product contains two parts: the control module and the motor winding section. Do not assume the motor or module is defective if it will not start. Go through the steps described below before replacing control module or entire motor. The control module is available as a replacement part.

A. It is normal for the motor to rock back and forth on startup. Do not replace the motor if this is the only problem identified.

B. If the motor is not running:

1. Check for proper high voltage and ground at the L,G, and N connections at the motor. Correct any voltage issue before proceeding to the next step.
2. The motor is communicated through 24-Vac signals to the 1,2,3,4,5 and C (common) terminals. Not all taps are programmed, if low voltage is applied to an non-programmed terminal, the motor will not operate, which is normal. Verify the part number of the motor matches the correct replacement motor part number for the unit model number.
3. Initiate a demand from the thermostat and check the voltage between C (common) and terminal 1- 5. If voltage is present and the motor isn't operating, then the motor/control module is failed.

C. Prior to installing the replacement control module, the motor section condition needs to be verified.

1. Check to see if the blower wheel spins freely.
2. To check for short to ground, use an ohmmeter to measure the resistance from any one of the motor connector pins to the aluminum end plate of the motor. This resistance should be greater than 100,000 ohms.
3. Check the motor phase-to-phase resistance between each of the leads in the three-pin motor connector. The lead-to-lead resistance across any two leads should be less than 20 ohms. Each lead-to-lead resistance should be the same within -/+ 10 percent.
4. If any motor fails any of the three tests, do not install a new control module. The new control can fail if placed on a defective motor.

The prior fan coil models with X-13 blower motors used a printed circuit board, similar to the PSC models. The current fan coils do not use the printed circuit board and rely on the motor control programming to provide the off-delay timing.

Another design aspect of the control board was to provide a resistor in the "G" circuit in case a power stealing thermostat was used. This resistor is no part of the wiring harness, as shown on wiring diagram. The resistor is a 2-watt, 1500-ohm resistor.

If the resistor has failed open, a likely cause is due to the power stealing thermostat. Connecting C (common) may resolve the issue. Having an open resistor should not affect the operation of the motor.

Fan Speed Selection

The fan speed selection is done at the motor connector. Units with or without electric heaters require a minimum CFM. Refer to the unit wiring label to ensure that the fan speed selected is not lower than the minimum fan speed indicated.

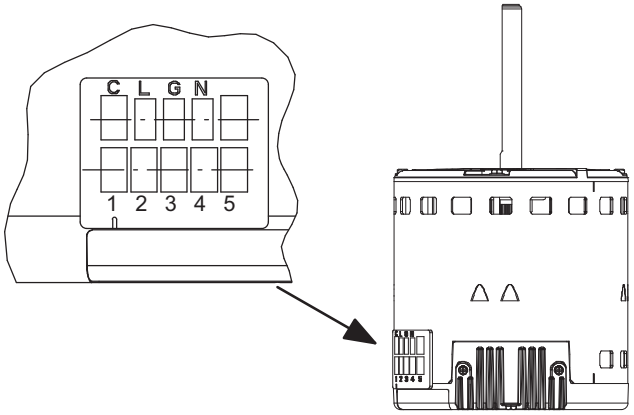
To change motor speeds disconnect the BLUE fan lead from motor connector terminal No. 2 (factory default position) and move to desired speed-tap; 1, 2, 3, or 5.

Speed-taps 1, 2, and 3 have a 90-second blower off time delay pre-programmed into the motor. Speed-tap 4 is used for electric heat only (with 0 second blower time delay) and the WHITE wire should remain on tap 4. Speed-tap 5 is used for high static applications, but has a 0-second blower time delay pre-programmed into the motor. See Airflow Performance tables for actual CFM. Also, see Fig. 4 for motor speed selection location.

NOTE: In low static applications, lower motor speed tap should be used to reduce possibility of water being blown off coil.

Tap 1	Low	90 sec off delay
Tap 2	Medium	90 sec off delay
Tap 3	High	90 sec off delay
Tap 4	Electric heat †	0 sec off delay
Tap 5	Max ‡	0 sec off delay

† electric heat airflow is same CFM as Tap 3, except 0 sec off delay
‡ high static applications, see airflow tables for max airflow



Speed Taps may be located on motor, or on plug close to motor.

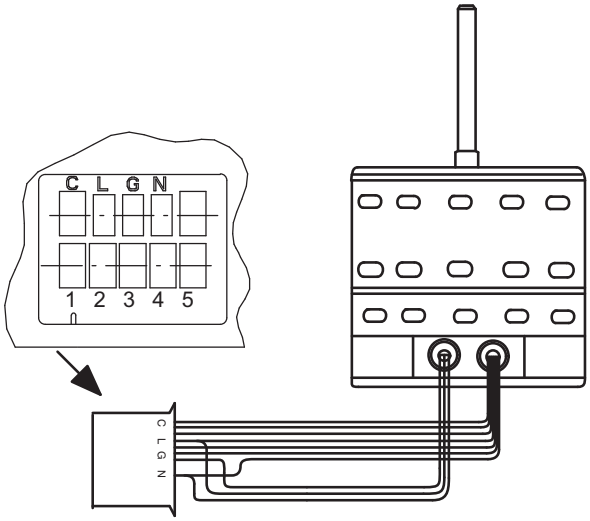


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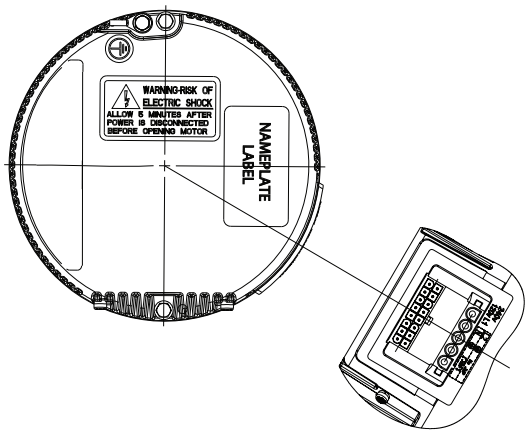
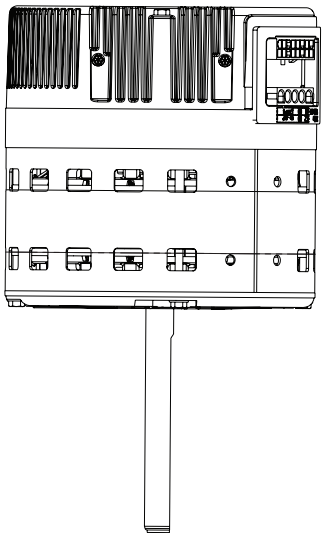
Fig. 4 - Motor Speed Selection for FB4C, FX4D & PF4 (odd sizes)





A13028

Fig. 5 - FV4 motor/ECM5.0 Motor

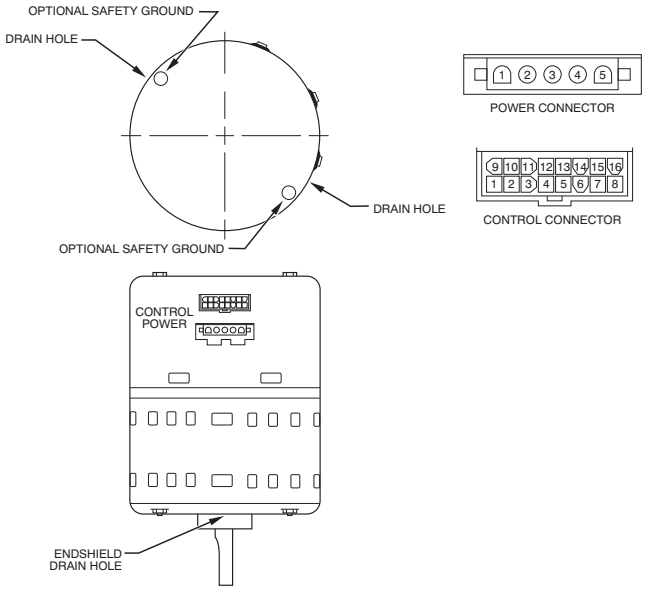


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Fig. 6 - FV4 motor/ECM2.3 Motor

FV4

Constant Air Flow

Unlike fan coils using induction motors where static pressure affects airflow, these fan coils are constant airflow units. The blower delivers requested airflow regardless of static pressure. Consult fan coil Product Data for static pressure limits. The ECM2.3/5.0 is pre-programmed and contains airflow tables for all modes of operation. Blower characteristics (requested airflow, torque, and speed) are known from laboratory testing If any two characteristics are known, the third is defined.

Requested airflow is known from Easy Select board configuration and thermostat signals. Torque is known because it is directly related to stator current, which is measured by motor control. Speed is measured by counting back EMF pulses from stator windings. This information is entered into an expression that calculates torque from speed and airflow numbers. If calculation does not match stored blower characteristics, torque is adjusted until agreement is reached. This calculation and adjustment is performed every 0.8 seconds while motor is in operation. There is no direct measure of static pressure, but unit does react to a change in static to maintain constant airflow. A change in pressure will result in a change in stator speed and torque. The motor will begin to adjust on the next sampling, calculate new desired speed and torque, and adjust as necessary.

INTEGRATED CONTROLS AND MOTOR ECM2.3/5.0

An ECM2.3/5.0 is fed high voltage AC power through the 5-pin connector. (See Fig. 6 or Fig. 5.) The AC power is then internally rectified to DC by a diode module. After rectification, DC signal is electronically communicated and fed in sequential order to three stator windings. The frequency of these commutation pulses determines motor speed. The rotor is permanently magnetized.

An ECM2.3/5.0 is powered with high voltage at all times. The motor will not run with high voltage alone. Low voltage must be applied to control plug to run motor.

ECM2.3/5.0 Control Power

The ECM2.3/5.0 control power is supplied from R circuit through printed circuit runs to motor control Connector-Pin 8, through motor control harness to motor. The C side of low-voltage control power circuit is connected by printed circuit runs to motor Connector -Pins 9, 10, and 11 then through motor control harness to motor.

Low-Voltage Circuit Fusing and Reference

The low-voltage circuit is fused by a board-mounted 5-amp automotive-type fuse placed in series with transformer SEC2 and R circuit. The C circuit of transformer is referenced to chassis ground through a printed circuit run at SEC1 connected to metal standoff marked.

NOTE: The PCB must be mounted with two screws and motor ground lead secured to blower housing or erratic motor operation can result.

Transformer, Motor, and Electric Heater Power Connection

Transformer high voltage supplied from electric heater package or high voltage leads through 12-pin heater connector plug/recp2. The ECM2.3/5.0 power connections are made at the transformer primary terminals. The transformer secondary connections are made at SEC1 and SEC2 connectors.

PCB LAYOUT AND DESCRIPTION (FV4)

NOTE: Layout of actual PCB is depicted in Fig.7.

The Easy Select Board is the interface between the ECM motor and other system components. The board offers choices of electric heater size, outdoor unit size and type, comfort or efficiency settings, on and off delay profiles, and continuous fan speed. The installer should select the correct size of components that are being installed in each installation. If no selections are made, the factory default settings are for the largest heater, largest outdoor unit, AC system type, nominal airflow adjust, and 0/90 time delay.

NOTE: Outdoor unit model should have an AHRI rating with the variable speed fan coil. Some outdoor unit models will not work properly with this fan coil.

Power for system is supplied from a 230-Vac, 60-Hz line. Class 2 voltage (24 Vac nom.), used for thermostat connections, is derived from transformer located in close proximity to PCB. The 24-Vac secondary circuit includes 5-amp automotive-type fuse in SEC2 circuit.

Connection to heater panel is made through 12-pin connector PL-1. Connections to thermostat are made at screw terminals. Twenty-one pin terminals comprise field select taps for motor.

Fuse Data: 5-amp automotive-type ATC/ATO (tan)

32V

200 percent current opening time of five seconds maximum

Electrical Connections

Twenty-one 0.110-in pin terminals are used to provide programming selections for operating modes of ECM2.3/5.0. The 6 selection modes are listed below. For additional information, refer to Easy Select Configuration Taps section.

AUX Heat Range—(Violet Wire)

AC/HP Size—(Blue Wire) Type—(Orange Wire)

AC/HP CFM Adjust—(Black Wire)

AC/HP Time Delay—(Grey Wire)

Continuous Fan—(Yellow Wire)

SEQUENCE OF OPERATION (FV4)

A. Continuous Fan Mode

The thermostat closes circuit R to G. The unit delivers the airflow selected for fan only operation.

B. Cooling Mode—Single Speed or Two-Speed High

Thermostat closes circuits R to G, R to Y/Y2 and R to O (heat pump only). A circuit R to Y1 is required for two-speed high operation. Airflow delivered the airflow selected by AC/HP SIZE selection and CFM ADJUST selection.

C. Cooling Mode—Two-Speed Low

Thermostat closes R to G and R to Y1 and R to O (heat pump only). Unit delivers two-speed low airflow for AC/HP SIZE and CFM ADJUST selected.

D. Cooling + Dehumidify Mode (Thermidistat or Comfort Zone II-B and Single-Speed Outdoor Unit Installed)

J1 jumper must be pulled from Easy Select Board. Control closes R to G, R to Y/Y2, and R to O (heat pump only) and open R to DH. Dehumidification is active when 24Vac is removed from DH terminal. Unit delivers 20 percent less airflow.

E. SuperDehumidify Mode

(Thermidisat or Comfort Zone II-B indoor control, Single-Speed Outdoor Unit)

This mode is only activated by the indoor control when COOL to DEHUMIDIFY and SUPERDEHUMIDIFY are configured at the control and there is a call for dehumidfication without a call for cooling. The control closes R to Y/Y2, R to O (heat pump only) and opens R to DH and R to G. This signals the fan coil to run at minimum airflow for maximum humidity removal. The control will cycle the equipment 10 minutes on and 10 minutes off until satisfied.

Table 1 – Motor and Modules

Model Size	Motor Type	Current Blower Motor P/N	Required Control Module Replacement Kit Number
FV4B_002	ECM2.3	HD44AE131	RMOD44AE131
FV4B_003	ECM2.3	HD44AE132	RMOD44AE132
FV4B_005	ECM2.3	HD44AE133	RMOD44AE133
FV4B_006	ECM2.3	HD46AE244	RMOD46AE244
FV4C_002 (Series A)	ECM2.3	HD44AR131	RMOD44AR131
FV4C_003 (Series A)	ECM2.3	HD44AR132	RMOD44AR132
FV4C_005 (Series A)	ECM2.3	HD44AR133	RMOD44AR133
FV4C_006 (Series A)	ECM2.3	HD46AR244	RMOD46AR244
FV4C_002 (Series B)	ECM5.0	HD44AR120	HK44ER120
FV4C_003 (Series B)	ECM5.0	HD44AR121	HK44ER121
FV4C_005 (Series B)	ECM5.0	HD44AR122	HK44ER122
FV4C_006 (Series B)	ECM5.0	HD46AR223	HK46ER223

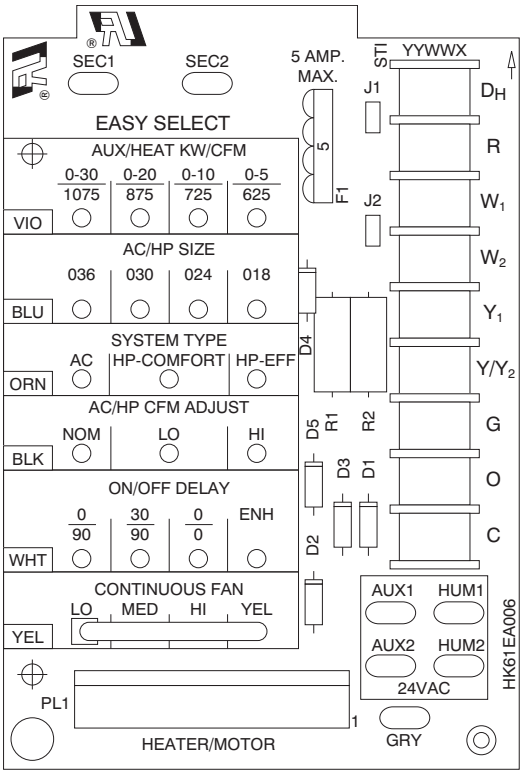

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Fig. 7 - Easy Select Board

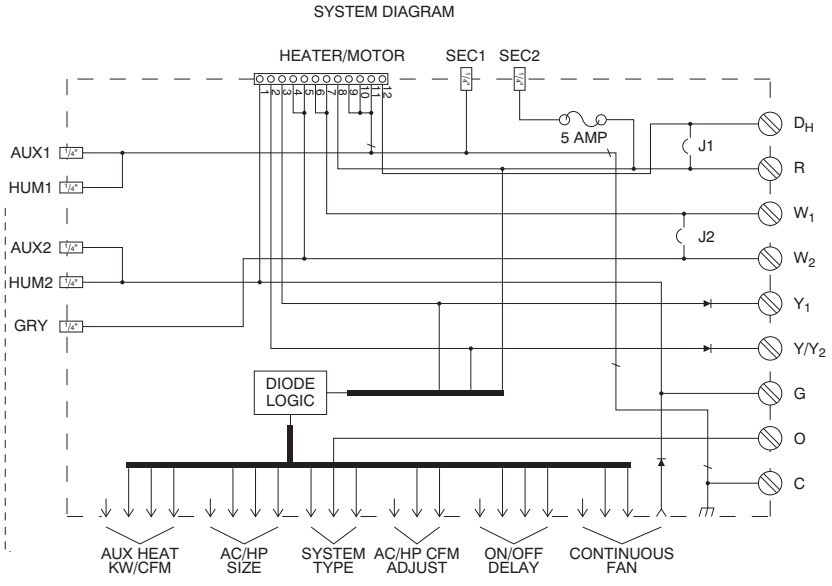

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Fig. 8 - Easy Select Board Schematic

Table 2 – Connections and Connectors (FK4C)

Type Connection	Type Connector	Pin No.	Description
Heater Connection	12-Pin	Pin 1	Common to screw terminal G
		Pin 2	Common to screw terminal Y/Y2 through diode D3
		Pin 3	Common through Y1 through diode D2
		Pin 4	Common to W2 screw terminal
		Pin 5	Common to W2 screw terminal
		Pin 6	Common to W1 screw terminal
		Pin 7	Common to W1 screw terminal
		Pin 8	R 24Vac
		Pin 9	Common to transformer C
		Pin 10	Common to transformer C
		Pin 11	Common to transformer C
		Pin 12	Common to DH screw terminal

Table 3 – Typical Operating Modes

Operating Mode	Terminals Energized
Heat Pump Only Heating	R, Y/Y2, G, DH
Heat Pump Only Heating + Super Comfort Heat Mode	R, Y/Y2, DH
Heat Pump Heating + Auxiliary Heat (non-staged)	R, Y/Y2, G, DH, W2
Cooling	R, Y/Y2, G, DH, O
Cooling + Dehumidification	R, Y/Y2, G, O
Cooling + Superhumidification	R, Y/Y2, O

F. Heat Pump Heating Mode — Single Speed or Two-Speed High

Thermostat closes R to Y/Y2 and R to G. A circuit R to Y1 is required for two-speed high operation. The unit delivers airflow selected by AC/HP SIZE selection and CFM ADJUST selection. Selected delay profile is active in this mode.

G. Heat Pump Heating Mode — 2-Speed Low

Thermostat closes R to G and R to Y1. Unit delivers two-speed low airflow for AC/HP SIZE and CFM ADJUST selected. Selected delay profile is active in this mode.

H. Non-Staged Auxiliary with Heat Pump Heating Mode

Thermostat should already have closed R to G, R to Y2 for heat pump heating operation. With J2 jumper in place, energizing either W1 or W2 will produce the W2 airflow. This is the greater of heat pump heating and auxiliary heat airflow plus an additional 15 percent. The elected delay profile is not active in this mode.

I. Staged Auxiliary Heat with Heat Pump Heating Mode

The auxiliary heat can be staged by removing the J2 jumper that ties W1 and W2 terminals together. Staging can be done by using outdoor thermostats or by using the Intelligent Heat Staging option where the indoor control can be configured for three-stage electric heat. The unit will automatically adjust airflow when the different stages of heat are energized. The airflow delivered will depend on the heat pump size selected and electric heat size selected. The greater of the two airflows will be delivered. The selected delay profile is not active in this mode.

J. Electric Heat without Heat Pump

Thermostat closes R to W and thermostat should be set up to energize G with W. This is due to the Super Comfort Heat programming in the motor. Energizing W without G will result in 25% lower airflow delivery. The selected delay profile is not active in this mode.

K. Super Comfort Heat Mode

This is a special heating mode only available on FV4 fan coils combined with a Thermidistat Control or Comfort Zone II-B. When this option is selected, the indoor control will monitor the outdoor temperature. The control will drop the G signal to the fan coil when the outdoor temperature is between 10° and 40° F. This triggers the motor to slow to approximately 213 CFM per ton. The heaters will stage as needed during this mode and the motor will adjust airflow as required. Below 10° F., the W1 control output will automatically energize on a call for heat. The ECM2.3/5.0 power connections are made at the transformer primary terminals. The transformer secondary connections are made at SEC1 and SEC2 connectors.

EASY SELECT CONFIGURATION TAPS

The Easy Select taps are used by installer to configure system. The ECM2.3/5.0 uses selected taps to modify its operation to a pre-programmed table of airflows. Airflows are based on system size and mode of operation and those airflows are modified in response to other inputs such as the need for de-humidification. (See Fig. 7.)

The FV4 Fan Coils must be configured to operate properly with system components with which it is installed. To successfully configure a basic system (see information printed on circuit board located next to select pins), move the six select wires to pins which match components used, along with homeowner preferences.

A. Auxiliary Heat Range

The installer must select the auxiliary heat airflow approved for application with kW size heater installed. Each select pin is marked with a range of heaters for which airflow (also marked) is approved. For increased comfort select the narrowest kW range matching the heater size, for example, 0-10 for a 10-kW heater. This airflow must be greater than the minimum CFM for electric heater application with the size system installed for safe and continuous operation. Note that airflow marked is the airflow which will be supplied in emergency heat mode and heating mode on air conditioners when electric heat is primary heating source. To ensure safe heater operation in heat-pump heating mode, when electric heaters are energized, the ECM2.3/5.0 will run the higher of heat pump airflow and electric heater airflow. The factory default selection is largest heater range approved. (See Fig. 7.)

B. AC/HP Size

The factory default setting for air conditioner or heat pump size is largest unit meant for application with model of fan coil purchased. The installer needs to select air conditioner or heat pump size to ensure that airflow delivered falls within proper range for size of unit installed in all operational modes. (See Fig. 7.)

Unpack unit and move to final location. Remove carton taking care not to damage unit. Inspect equipment for damage prior to

installation. File claim with shipping company if shipment is damaged or incomplete.

Locate unit rating plate which contains proper installation information. Check rating plate to be sure unit matches job specifications.

C. System Type

The type of system must be selected.

1. AC—air conditioner (approx. 350 CFM/ton)
2. HP-COMFORT—provides lower airflow than air conditioner selection (approximately 315 CFM/ton) in heating mode. In cooling mode supplies 350 CFM/ton.
3. HP-EFF—provides same airflow for heat pump heating and cooling modes (approximately 350 CFM/ton).

The factory setting is AC. (See Fig. 7.)

D. AC/HP CFM Adjust

Select low, nominal, or high airflow. The factory selection is NOM. The adjust selections HI/LO will regulate airflow supplied for cooling and heat pump heating modes only, +15 percent and -10 percent respectively. The adjust selection options are provided to adjust airflow supplied to meet individual installation needs for such things as noise, comfort, and humidity removal. (See Fig. 7.)

E. ON/OFF Delay

NOTE: ON/OFF Delay is active only in cooling and heat pump only heating modes. In auxiliary heat mode or emergency heat mode, the ON delay is 0 seconds and the OFF delay is fixed and cannot be overridden.

Select desired time delay profile. Four motor-operation delay profiles are provided to customize and enhance system operation. (See Fig. 7.) The selection options are:

1. The standard 90-seconds off delay (factory setting 0/90).
2. No delay option used for servicing unit or when a thermostat is utilized to perform delay functions (0/0).
3. A 30-seconds on/90-seconds off delay profile used when it is desirable to allow system coils time to heat up/cool down prior to airflow. This profile will minimize cold blow in heat pump operation and could enhance system efficiency (30/90).
4. ENH, enhanced selection provides a 30-seconds on/150-seconds at 70 percent airflow and no off delay.

F. Continuous Fan

Select desired continuous-fan profile LO, MED, or HI. Airflow are provided to customize and enhance the continuous fan functions. (See Fig. 7.) The possible selections are:

1. LO—provides 50 percent of Y/Y2 Cool airflow.
2. MED—provides 65 percent of Y/Y2 Cool airflow (71 percent on 006 model).
3. HI—provides 100 percent of Y/Y2 Cool airflow.

The factory setting is LO.

NOTE: If applied to two-speed unit, do not select continuous fan as HI since low speed cooling will also run at HIGH airflow and insufficient dehumidification may result.

G. Easy Select Board Jumpers

J1 - This jumper must be pulled to activate dehumidification mode. The jumper connects R to DH. With the jumper in, the DH terminal is always energized. With the jumper pulled, the DH terminal is de-energized. A control such as the Thermidistat must be used to supply the 24-V signal when there is no call for dehumidification, and turn off the 24-V when there is a call for dehumidfication.

J2 - This jumper activates heat staging. The jumper connects the W1 and W2 terminals together. If either is energized, W2 airflow is delivered. With the jumper pulled, there are separate airflows for W1 and W2.

H. Airflow Delivery

These units deliver airflow depending on the system size selections and operating mode. The thermostat energizes a combination of terminals on the Easy Select Board which tells the motor what CFM to deliver. The following are typical operating modes and the terminals that should be energized on the Easy Select Board.

NOTE: The DH terminal on the Easy Select Board is for dehumidification. It is de-energized on a call for dehumidification.

I. Variable Speed Motor Logic Sequence:

The ECM motors in these fan coils are programmed to deliver a variety of airflows. The motor goes through:

COOLING

The nominal cooling airflow for these fan coils is 350 CFM per ton. Selecting the HI adjust tap increases the airflow to 400 CFM per ton. The LO tap decreases airflow to 315 CFM per ton. The low adjustment is only active during normal cooling mode. Removing the signal from the DH terminal reduces the airflow to 80 percent of cooling airflow. Removing the G signal for Superdehumidify reduces the airflow to 50 percent of cooling.

HEATING

The base heat pump only heating airflow is determined by the SYSTEM TYPE selection on the Easy Select Board. If HP-EFFICIENCY is selected, the airflow is the same as Cooling. IF HP-COMFORT is selected, the airflow is 315 CFM per ton. The airflow will adjust up if necessary when auxiliary heating is required. When both the Y/Y2 and W1 or W2 terminals are energized, the motor will run the higher of the heat pump or electric heat airflows. During Super Comfort Heat mode, the indoor control removes the G signal from the board. This slows the motor to 75 percent of heat pump airflow. If the CFM adjust is set to LO, it will deliver 67.5 percent of heat pump airflow during Super Comfort Heat mode.

TROUBLESHOOTING

A. Troubleshooting Easy Select Board (FV4)

If Traces Are Overheated on Back of PCB:

Usually whenever there is a trace broken on PCB, it means either there has been a high-voltage short or high voltage has been applied to low-voltage circuit. This can be prevented by making sure PCB is wired correctly before fan coil has power applied to it.

If PCB Fuse Keeps Blowing:

When low-voltage fuse blows, it means transformer would have blown if fuse had not been in circuit to protect it. The fuse usually blows when there is a high current drawn on transformer, high voltage applied to low-voltage circuit, or a direct secondary short. When there is a high current drawn on transformer, it is most likely because transformer has been shorted or system is trying to draw more Vac than transformer rating allows. When fuse blows because of high voltage, the system has mixed high and low-voltage signals.

1. Check transformer and thermostat wiring. (See Fig. 7.) Be sure transformer is not shorting out because thermostat wires are miswired.
2. Check wiring of relays. (See Fig. 7.) Be sure low-voltage and high-voltage wiring are connected to proper sequencers.
3. Check VA draw on transformer. If VA draw is more than VA rating of transformer, fuse will blow. If this is the case, replace transformer with one that has a higher VA rating.

B. Troubleshooting Common Problems

Airflow Too Low:

Y1 instead of Y/Y2 on single-speed air conditioner or heat pump application. Y1 input is only for two-speed applications. Using this terminal will deliver about 60 percent of full cooling airflow.

Wrong Easy Select Board selection. Selecting an outdoor unit or electric heater smaller than actually installed will result in low airflow for the application.

G not energized with call for cooling or heating. This triggers Super Comfort Heat or SuperDehumidify mode which delivers 50 percent of cooling airflow.

J1 jumper pulled with no thermidistat or dehumidistat installed. The J1 jumper ties the DH terminal to R and is installed at the factory. When pulled, a Thermidistat or dehumidistat supplies a 24-V signal to DH when there is no call for dehumidification (reverse logic). When there is no signal on DH, the motor reduces airflow to 80 percent for better dehumidification.

Airflow Too High:

Wrong Easy Select Board selection. Fan coil is factory set for the largest outdoor unit and largest electric heater. Select sizes that are actually installed.

Continuous fan set too high for two-speed applications. Set to MED or LO.

Motor Will Not Stop:

Allow time for off delay to time out. In units built before serial number 0101A, any W call will have a two-minute off delay independent of delay selection. This is programmed into the motor and cannot be overridden.

In units built after 0101A, the off delay on any W call is one minute and cannot be overridden.

Some power-stealing thermostats could bleed enough voltage to cause motor to run slowly when there is no heating or cooling call. Disconnect thermostat wires and wait two minutes to see if motor stops. If it stops, replace thermostat, or install resistor per thermostat installation instructions.

Motor Will Not Start:

See following section, "Troubleshooting ECM2.3/5.0 Motor and Controls"

C. Troubleshooting ECM2.3/5.0 Motor and Controls

⚠ CAUTION

ELECTRICAL OPERATIONS HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

High voltage is always present at motor. Disconnect power to unit before removing or replacing connectors or servicing motor. Wait at least five minutes after disconnecting power before opening motor.

The ECM/ICM motor used with this product contains two parts: the control module and the motor winding section. Do not assume the motor or module is defective if it will not start. Go through the steps described below before replacing control module, Easy Select Board or entire motor. The control module is available as a replacement part.

D. If Motor Turns Slowly:

1. It is normal operation to run noticeably slower if G terminal is not energized in cooling or heat pump heating modes.
2. Attach blower access panel. Motor may appear to run slowly if access panel is removed.

E. If Motor Does Not Run:

Turn power off, wait five minutes and check the following:

1. With power turned off, check 5-amp fuse on Easy Select Board.
2. Check all plugs and receptacles for any deformation or corrosion that could cause bad connections. Be sure plugs are fully seated.

⚠ CAUTION

ELECTRICAL OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

DO NOT remove or apply 5-pin plug on motor with power on. Arcing could occur, which can damage control module

Turn power back on and check the following:

3. Check for 24Vac on SEC1 and SEC2. If no voltage is present, check transformer.
4. Verify that approximately 230Vac is present at motor.
5. Verify low voltage control signals to motor according to procedure below.

Use following procedure to check low voltage signals:

The ECM motor in these fan coils receive low voltage signals from the Easy Select Board through the wiring harness assembly. The combination of pins energized at the motor determines the speed the motor will run. The procedure below isolates the fan coil from all external devices such as a thermostat, condensing unit, humidifier or electronic air cleaner. There is also a specific troubleshooting example to demonstrate the process. Table 7 provides information needed to verify that the correct voltages are present at the motor and the Easy Select Board.

THERMOSTAT:

1. Remove all thermostat and accessory wires from Easy Select Board.
2. On Easy Select Board, jumper screw terminals (1 at a time): R-G, R-Y/Y2, R-Y1, R-W1, R-W2. If motor runs in all cases, check thermostat outputs. Thermostat wires may be broken, or thermostat may be miswired, configured incorrectly, or defective. If the motor does not run, or runs in some cases, but not others, continue this procedure to check wiring harness and circuit board.

WIRING HARNESS:

1. Remove 16-pin plug from motor.
2. Check for appropriate voltages on 16-pin connector with screw terminals jumpered. (See Table 2.)
3. If signals check correctly, and motor does not run, inspect wiring harness for loose pins or damaged plastic that could cause poor connections.
4. If connections are good, either control module or motor is defective.
5. If proper signals are not present, check circuit board using procedure below:

12-PIN PLUG (PL-1) ON EASY SELECT BOARD:

1. Completely disconnect wire harness from Easy Select Board.
2. Jumper the screw terminals one at a time; R-G, R-Y/Y2, R-Y1, R-W1, R-W2 and check for appropriate voltages on the Easy Select Board pins. If proper signals are not present, replace Easy Select Board. If proper signals are present at the pins and not at 16-pin connector to the motor, the wiring harness is defective.

TROUBLESHOOTING EXAMPLE:

Motor is not running on a call for heat pump heating after jumpering the Easy Select Board screw terminals as described in Thermostat section above.

With all thermostat wires removed from Easy Select Board, place a jumper wire between R and Y/Y2 low-voltage screw terminals on the Easy Select Board.

1. Check Table 4 for pin number on 16-pin connector associated with the Y/Y2 signal. The correct pin is No. 14. The far

right column of Table 4 shows that (-) 12Vdc should be present between Pin No. 14 and Pin No. 1 (common) on the 16-pin connector.

2. Set meter to read DC voltage. Place meter leads between Pins No. 1 (common) and No. 14 and check for (-) 12Vdc. If signal is present, the problem is in the module or motor. If signal is not present, the problem is either in wiring harness or Easy Select Board.

These steps can be repeated for other modes of operation.

To check Easy Select Board:

1. Leave jumper wire in place between R and Y/Y2.
2. Check Table 4 under "Volt Meter on Easy Select Board Plug" column and row for Pin No. 14 on motor plug to see pin number on Easy Select Board that should have voltage. The correct pin is No. 2. The column on far right will show voltage that should be present between Pin No. 2 and Pin No. 9 (common).
3. Place meter leads between Pins No. 2 and No. 9 on Easy Select Board and check for (-) 12Vdc.
4. If voltage is present, the wiring harness is bad. If not, the Easy Select Board is bad.

Verify Motor Winding Section:

Before proceeding with module replacement, check the following to ensure motor winding section is functional. With control module removed and unplugged from winding section:

1. The resistance between any two motor leads should be similar.
2. The resistance between any motor lead and the unpainted motor end plate should be greater than 100,000 ohms.

If motor winding fails one of these tests, it is defective and must be replaced.

F. Accessories

AUXILIARY TERMINALS

The AUX and HUM terminals on the Easy Select Board are tied directly to the G terminal, and provide a 24-Vac signal whenever the G terminal is energized (See Fig. 8). During Superdehumidify mode, the G signal is not present and the auxiliary terminals are not energized. If the installation includes the use of this operating mode, do not use these terminals to control accessories. See Electronic Air Cleaner and Humidifier sections for further information.

ELECTRONIC AIR CLEANER CONNECTIONS

The AUX1 and AUX2 terminals are not always energized during blower operation, as described above. When using an electronic air cleaner with the FV4 fan coil, use Airflow Sensor. The airflow sensor turns on electronic air cleaner when the fan coil blower is operating.

HUMIDIFIER / HUMIDISTAT CONNECTIONS

Easy Select Board terminals HUM1 and HUM2 are provided for direct connection to the low-voltage control of a humidifier through a standard humidistat. These terminals are energized with 24Vac when G thermostat signal is present. Alternately, the 24-Vac signal may be sourced from the W and C terminal block connections when electric heaters are used as primary heating source. When using a Thermidistat™ Control, Zone Perfect Plus, or Comfort Zone II, the 24-Vac signal may be source directly from the Thermidistat HUM terminal.

G. FV4 Dehumidify Mode

NOTE: Humidistat must open on humidity rise.

Latent capacities for systems using the FK4, FV4, and 40FK fan coils are better than average systems. If increased latent capacity is an application requirement, the field wiring terminal block provides connection terminals for use of a standard humidistat. The FK4, FV4, and 40FK fan coils will detect the humidistat contacts opening on increasing humidity and reduce its airflow to approximately 80 percent of nominal cooling mode airflow. This reduction will increase the system latent capacity until the humidity falls to a level which causes the humidistat to close its contacts. When the contacts close, airflow will return to 100 percent of the selected cooling airflow. To activate this mode, remove jumper J1 and wire in a standard humidistat. Carefully consult product airflow data for cooling and dehumidification modes.

Table 4 – FV4 Motor Control Test Values (With 16-pin connector at motor unplugged)

Terminals Jumpered	Volt Meter on 16-pin Harness Plug		Volt Meter on 12-pin Easy Select Board Plug		Voltage
	+	-	+	-	
R to W1	Pin 2	Pin 1	Pin 7	Pin 9	24Vac
R to W2	Pin 13	Pin 1	Pin 4	Pin 9	24Vac
R to Y1	Pin 6	Pin 1	Pin 3	Pin 9	(-)12Vdc
R to Y/Y2	Pin 14	Pin 1	Pin 2	Pin 9	(-)12Vdc
R to G (LO)	Pin 15	Pin 1	Pin 3	Pin 9	0Vac
R to G (MED)	Pin 6	Pin 1	Pin 3	Pin 9	(-)12Vdc
R to G (HI)	Pin 14	Pin 1	Pin 2	Pin 9	(-)12Vdc

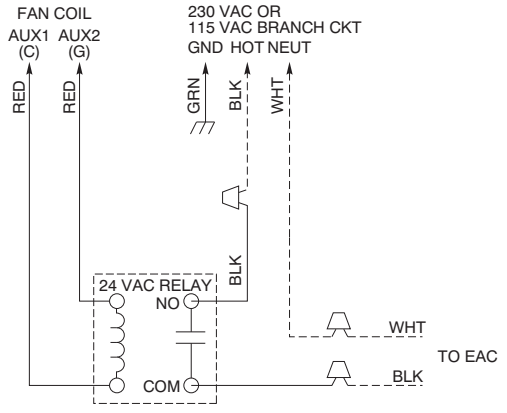

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Fig. 9 - KFAIR0201ACR Relay Kit Wiring Schematic

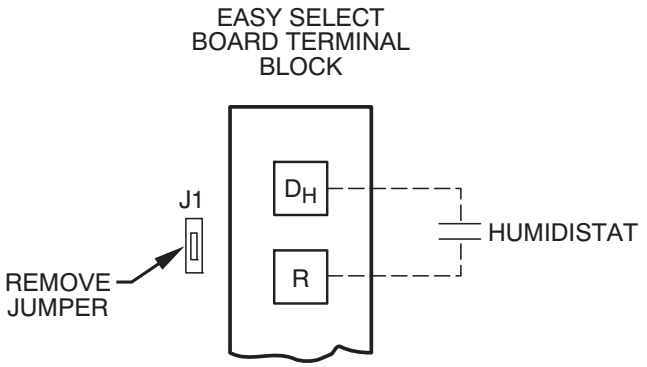

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Fig. 10 - Humidistat Wiring for De-Humidify Mode

FE4

Model FE4A fan coil is designed to be installed with a communicating user interface. The FE4A fan coil will provide airflow at a rate commanded by the User Interface. The nominal airflow/ton rate is 350 CFM/ton. The User Interface will modify the commanded airflow under certain operating modes. Refer to the User Interface literature for further system control details. This fan coil will not respond to commands from a common thermostat except under certain emergency situations explained in this document.

ELECTRONICALLY COMPUTED MOTOR ECM3.0

An ECM3.0 is fed high voltage AC power through the 5-pin connector. The AC power is then internally rectified to DC by a diode module. After rectification, DC signal is electronically communicated and fed in sequential order to 3 stator windings. The frequency of these communication pulses determines motor speed. The rotor is permanently magnetized.

ECM3.0 CONTROL POWER

The ECM3.0 control power is supplied from R circuit through printed circuit runs to motor control connector Plug 1, Pin 1, through motor control harness to motor. The C side of low-voltage control power circuit is connected by printed circuit runs to motor connector Plug 1, Pin 2 then through motor control harness to motor. A digital signal is sent from Plug 1, Pins 3 and 4 to communicate with the motor including all airflow requirements.

LOW-VOLTAGE CIRCUIT FUSING AND REFERENCE

The low-voltage circuit is fused by a board-mounted 5-amp automotive type fuse placed in series with transformer SEC2 and R circuit. The C circuit of transformer is referenced to chassis ground through a printed circuit run at SEC1 connected to metal standoff.

NOTE: The PCB must be mounted with two screws and motor ground lead secured to blower housing or erratic motor operation can result.

TRANSFORMER, MOTOR, AND ELECTRIC HEATER POWER CONNECTION

Transformer high voltage supplied from electric heater package or high voltage leads through 12-pin heater connector plug/recp2. The ECM3.0 power connections are made at the transformer primary terminals. The transformer secondary connections are made at SEC1 and SEC2 connectors.

TROUBLESHOOTING (FE4)

NOTE: Always check high and low voltage supply to the fan coil components. Check the integrity of the plug receptacle connections and fan coil wiring harness prior to assuming a component failure.

A. LED Description:

LEDs built into fan coil control provide installer or service person information concerning operation and/or fault condition of the fan coil control and ECM motor. This information is also available at system User Interface in text with basic troubleshooting instructions. Careful use of information displayed will reduce the need for extensive manual troubleshooting.

The amber LED located at bottom center of control adjacent to motor harness plug is Motor Status LED, and it is labeled MOTOR. A second amber LED, located in upper right center of control adjacent to System Communications connector (A,B,C,D), is the System Status LED, and it is labeled STATUS. The green LED labeled COMM is also located adjacent to System Communications connector, below STATUS LED, and is used as an indicator of system communications status. Status Codes will be displayed on the STATUS LED using the following protocol:

1. The number of short flashes indicates first digit of code.
2. The number of long flashes indicates second digit of code.
3. A short flash is 0.25 seconds on. A long flash is one second on.
4. The time between flashes is 0.25 seconds.
5. The time between last short flash and first long flash is 1 second.
6. The LED will be off for 2.5 seconds before repeating code.

B. Fan Coil Control Start-Up and System Communications Troubleshooting:

On power up, green COMM LED will be turned off until successful system communications are established (this should happen within 10 seconds). Once communications with User Interface are successful, COMM LED will be lit and held on. At the same time, amber STATUS LED will be lit and held continuously on until a request for operating mode is received. The STATUS LED will be on any time fan coil is in idle mode.

If, at any time, communications are not successful for a period exceeding two minutes, fan coil control will only allow emergency heating or cooling operation using a common thermostat, a non-communicating outdoor unit and the R, C, Y, O, W outdoor unit terminal strip connections and will display **Status Code 16, System Communication Fault**, on amber STATUS LED. No further fan coil troubleshooting information will be available at User Interface until communications are re-established.

If COMM LED does not light within proper time period and status code is not displayed:

1. Check system transformer high and low voltage to be sure the system is powered.
2. Check fuse on fan coil control to be sure it is not blown. If fuse is open, check system wiring before replacing it to be sure a short does not cause a failure of replacement fuse.

If COMM LED does not light within proper time period and status code is displayed:

Check system wiring to be sure User Interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted. Mis-wiring or shorting of the ABCD communications wiring will not allow successful communications.

NOTE: Shorting or mis-wiring low voltage system wiring **will not** cause damage to fan coil control or User Interface but may cause low voltage fuse to open.

C. ECM Motor Troubleshooting

The ECM motor used in this product consists of two parts: the control module and the motor winding section. Do not assume motor or module is defective if it will not start. Use the designed-in LED information aids and follow troubleshooting steps described below before replacing motor control module or entire motor. Motor control module is available as a replacement part.

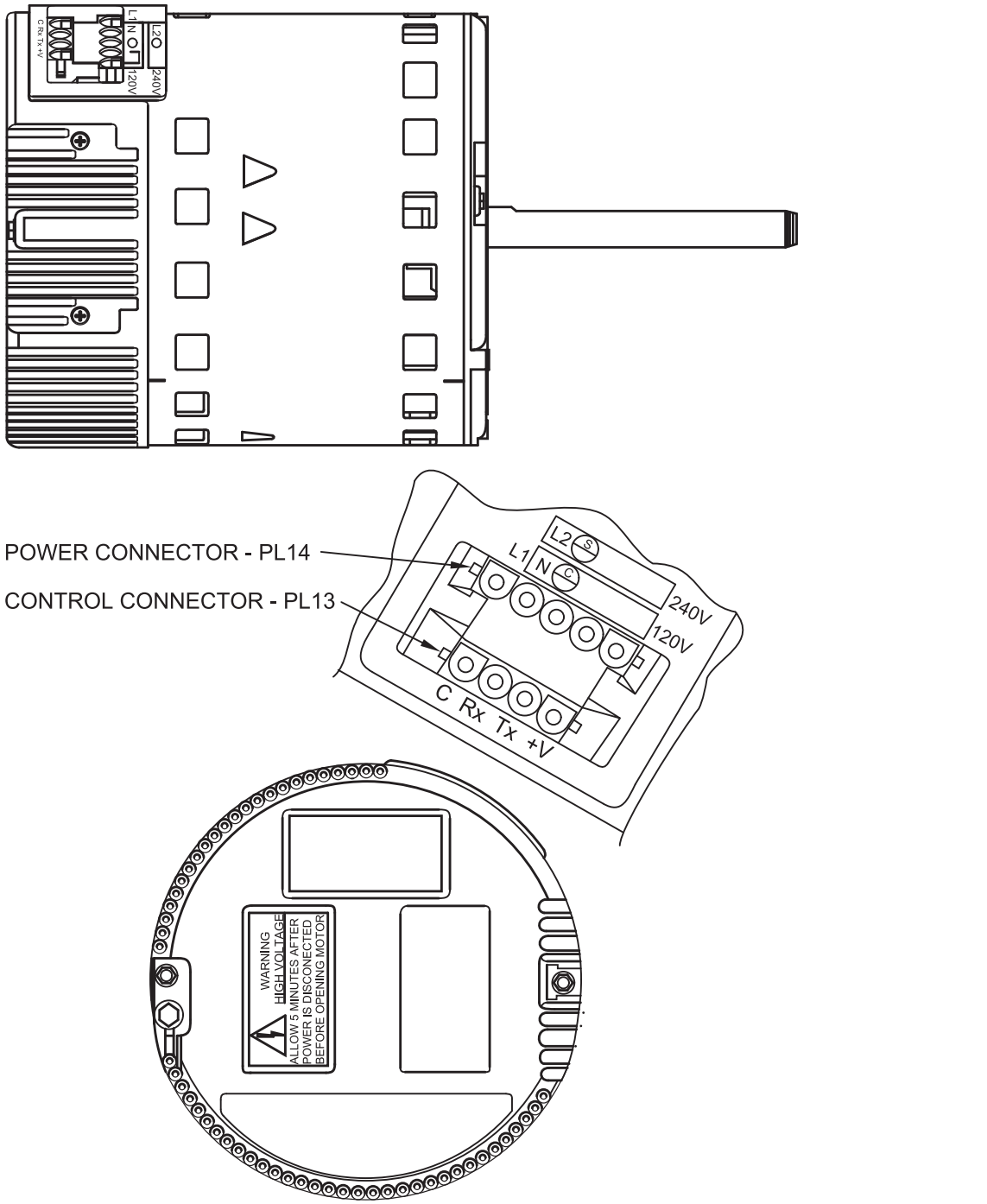

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Fig. 11 - FE4A ECM3.0 Motor

VERIFY MOTOR WINDING SECTION:

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death or possible equipment damage.

After disconnecting power from the ECM motor, wait at least five minutes before removing the control section. Internal capacitors require time to discharge. Minor injury from electrical shock may result from early contact with live metal parts.

Before proceeding to replace a motor control module:

1. Check motor winding section to be sure it is functional.
2. Remove motor control module section and unplug winding plug. Motor shaft should turn freely, resistance between any two motor leads should be similar and resistance between any motor lead and unpainted motor end should exceed 100,000 ohms.
3. Failing any of these tests, entire ECM motor must be replaced.
4. Passing all of the tests, motor control module alone can be replaced.

MOTOR TURNS SLOWLY:

1. Low static pressure loading of blower while access panel is removed will cause blower to run slowly. Particularly at low airflow requests. This is normal, do not assume a fault exists.
2. Recheck airflow and system static pressure using User Interface service screens with access panel in place.

NOTE: Blower motor faults will not cause a lockout of blower operation. Fan coil control will attempt to run the blower motor as long as User Interface maintains a demand for airflow. Fan coil control will not operate electric heaters while a fault condition exists. The fan coil control communicates with the motor at least once every five seconds, even when the motor is idle. If, during operation, the fan coil control does not communicate with the motor for more than 25 seconds, the motor will shut itself down and wait for communications to be reestablished.

D. Using Motor LED in Troubleshooting

The MOTOR LED is connected to the blower motor communication line and works with the fan coil control microprocessor and the STATUS LED to provide fan coil operation and troubleshooting information. When the motor is commanded to operate, the MOTOR LED will be turned on and will flash each time instructions are sent to the motor. When the motor is commanded to stop, the MOTOR LED will be turned off.

If the MOTOR LED is lit, flashing and the motor is running or if the MOTOR LED is off and the motor is stopped, operation is normal and no motor fault exists.

If the MOTOR LED is lit, flashing and the motor does not run, or if the MOTOR LED is off and the motor is running, check the STATUS LED for the Status Code. Refer to the troubleshooting instructions for the indicated Status Code in Section E, Fan Coil Troubleshooting.

E. Fan Coil Troubleshooting

Fan coil faults indicated by flashing codes on the amber system STATUS LED can be resolved using troubleshooting information provided below. Codes are listed in order of their priority, highest to lowest. Though multiple faults can exist at any time, only the highest priority code will be displayed on STATUS LED. Clearing the indicated fault when multiple faults exist will cause the next highest priority Status Code to be flashed. All existing faults, as well as a fault history, can be viewed at User Interface.

STATUS CODE 45, CONTROL BOARD TEST FAULT:

Fan coil control has failed internal start-up tests and must be replaced. No other service procedure will correct.

STATUS CODE 37, HEATER OUTPUT SENSED ″ON″ WHEN NOT ENERGIZED:

Fan coil control is provided with circuitry to detect presence of a 24-Vac signal on Electric Heater stage 1 and stage 2 outputs.

If fan coil control detects a 24-Vac signal on either heater stage output and it is not supplying signal, Status Code 37 will be displayed on STATUS LED. Fan coil control will turn off output and command blower motor to supply an airflow determined to be safe for current operation mode with electric heaters energized.

To find the fault:

1. Stop all system operations at User Interface and check heater stage 24-Vac outputs.
2. Disconnect electric heater at plug/receptacle 2 and check heater wiring for faults. See Status Code 36 for more information.

STATUS CODE 44, MOTOR COMMUNICATION FAULT:

The MOTOR LED is connected to the blower motor communication line and works with the fan coil control microprocessor and STATUS LED to provide fan coil operation and troubleshooting information.

When motor is commanded to operate, the MOTOR LED will be turned on and will flash each time instructions are sent to the motor.

When the motor is commanded to stop, the MOTOR LED will be turned off. The MOTOR LED will not flash to indicate communications when it is turned off.

Fan coil control is constantly communicating with the motor, even when the motor and MOTOR LED are off. If motor does not acknowledge receipt of communications, the control will display Status Code 44 on STATUS LED and continue to try to communicate with the motor. If motor acknowledges communication, status code will be cleared.

If MOTOR LED is lit and flashing and motor does not run:

1. Check the STATUS LED. If STATUS LED is indicating a Status 44 code, check the motor wiring harness for proper connection to control and motor receptacles.
2. Check motor wiring harness to be sure all wiring complies with wiring diagram description, makes a complete circuit from connector to connector and is not shorted.
3. Check 12-Vdc low-voltage supply to motor at Pins 1 (+) and 2 (-) of motor header connection to fan coil control.

If all checks are normal, fan coil control is good and control module on motor may need replacement. Check motor and Motor Control Module following the instructions in Section C. ECM Motor Troubleshooting.

Shorted or mis-wiring of the low voltage motor harness wiring will not cause damage to fan coil control or to motor control module.

If the MOTOR LED is off, STATUS LED is indicating a Status Code 44 and motor is running:

Disconnect the motor harness at the fan coil control. If motor continues to run, fan coil control is good and control module on motor may need replacement

STATUS CODE 25, INVALID MOTOR / MODEL SELECTION:

On initial start-up, fan coil control shall poll motor for its size data and check fan coil size data stored in fan coil control memory.

1. If motor size is incorrect for fan coil size or fan coil size data is invalid, Status Code 25 will be displayed on STATUS LED.
2. If model size data is missing (as is the case when a replacement fan coil control is installed), system User Interface will prompt installer to enter correct model size from a list of valid sizes.
3. If motor size is incorrect for model size, motor must be replaced with proper size motor. **Fan coil control will not respond to operation requests until this fault condition is resolved.**

STATUS CODE 27, INVALID OUTDOOR UNIT SIZE:

On initial power-up, fan coil control will write into memory outdoor unit size as provided by User Interface in a fully communicating system.

1. If outdoor unit size is invalid, Status Code 27 will be displayed on STATUS LED.
2. User Interface will prompt the installer to choose size from a list of valid sizes for application with fan coil.
3. Check communications wiring to be sure User Interface has established communications with outdoor unit or select proper size from valid size list provided at User Interface.
4. Check motor and motor control module following the instructions in Section C. ECM Motor Troubleshooting.

STATUS CODE 26, INVALID HEATER SIZE:

On initial power-up, fan coil control will write into memory electric heater size as read from heater if heater is provided with Identifier Resistor (IDR). Heater size must be valid for combination of indoor and outdoor components installed. Fan coil control will read IDR value connected to Pins 5 and 8 of heater harness connector. If no resistor is found, system User Interface will prompt installer to verify that no heater is installed.

Verifying that this is correct will establish that fan coil is operating without an electric heater accessory. Upon choosing negative option, installer will be prompted to select heater size installed from a list of valid heater sizes for fan coil and outdoor unit size installed.

If heater ID resistor value read is invalid, Status Code 26 will be displayed on STATUS LED.

If heater installed is equipped with a resistor connected to Pins 5 and 8 of heater harness connector and Status Code 26 is displayed on STATUS LED:

1. Check wiring harness connections to be sure connections are secure.
2. If symptoms persist, disconnect wiring harness at fan coil control heater header and check for a resistance value greater than 5000 ohms.
3. Check for proper wiring of resistor assembly.
4. Make sure heater size installed is an approved size for outdoor unit and fan coil sizes installed.

NOTE: Fan coil control will not operate electric heater until this Status Code is resolved. If the heater size is set through the User Interface, the heater will be operated as a single stage heater. If staging is desired, the IDR value must be read in by the fan coil control.

Table 5 – FE4 self-identifying resistor values

Heater Size kW	Resistor Ohms Nominal
No heater	Open
9	11k
15	18k
20	24k
24	33k
30	39k
Hydronic Heat	270k

STATUS CODE 36, HEATER OUTPUT NOT SENSED WHEN ENERGIZED:

Fan coil control is provided with circuitry to detect presence of a 24-Vac signal on Electric Heater stage 1 and stage 2 outputs.

If fan coil control energizes either heater stage and does not detect the 24-Vac signal on output, Status Code 36 will be displayed on the STATUS LED Fan coil control will continue to energize heater output(s) and adjust blower operation to a safe airflow level for energized electric heat stage(s).

To find the fault, check for 24Vac on heater stage outputs. Fan coil control or sensing circuit may be bad.

NOTE: It may be useful as an electric heater troubleshooting procedure to disconnect the system communications to force Status Code 16 enabling of emergency heat mode. It is difficult to know which heater output is energized or not energized in normal operation. When fan coil is operated in emergency heat mode using electric heaters, both outputs are energized and de-energized together. Terminal strip inputs to control can then be connected R to W to turn on both electric heat outputs. Heater output sensing circuits can then be checked to resolve Status Code 36 or 37 problems.

STATUS CODE 41, BLOWER MOTOR FAULT:

If MOTOR LED is lit and flashing and motor does not run:

1. Check STATUS LED. If STATUS LED is indicating Status Code 41, motor control has detected that the motor will not come up to speed within 30 seconds of being commanded to run or that the motor has been slowed to below 250 rpm for more than 10 seconds after coming up to speed. Motor wiring harness and fan coil control are operating properly, do not replace.
2. Check to be sure that the blower wheel is not rubbing the housing.
3. Check motor to be sure that the motor shaft is not seized (motor control module must be removed and electronics disconnected from windings to perform this check properly).
4. Check motor windings section following instructions in Section C. ECM Motor Troubleshooting.

If all these checks are normal, the motor control module may need replacement.

STATUS CODE 16, SYSTEM COMMUNICATION FAULT:

If, at any time, system communications are not successful for a period exceeding two minutes, the fan coil control will only allow emergency heating or cooling operation using a common thermostat, a non-communicating outdoor unit, and the R, C, Y, O,W outdoor unit terminal strip connections and will display Status Code 16 on the amber STATUS LED (see section E, Emergency Heating and Cooling Modes). No further fan coil troubleshooting information will be available at the User Interface until communications are reestablished.

Check system wiring to be sure the User Interface is powered and connections are made A to A, B to B, etc. and wiring is not shorted. Mis-wiring or shorting of the ABCD communications wiring will not allow successful communications. Correcting wiring faults will clear the code and reestablish communications.

Shorting or mis-wiring the low voltage system wiring will not cause damage to fan coil control or to User Interface but may cause the low voltage fuse to open.

STATUS CODE 46, BROWNOUT CONDITION:

If the secondary voltage of the transformer falls below 15Vac for a period exceeding four seconds, Status Code 46 will be displayed on STATUS LED.

If system includes a non-communicating outdoor air conditioner or heat pump, the User Interface will command the fan coil to turn off Y output controlling compressor.

When secondary voltage rises above 17Vac for more than four seconds, the brownout condition is cleared and normal system operation will resume subject to any minimum compressor off delay function which may be in effect. Brownout does not affect blower or electric heater operation.

STATUS CODE 53, OUTDOOR AIR TEMPERATURE SENSOR FAULT:

If an OAT sensor is found at power-up, input is constantly checked to be within a valid temperature range. If sensor is found to be open or shorted at any time after initial validation, Status Code 53 will be displayed at amber STATUS LED.

Check for faults in wiring connecting sensor to OAT terminals. Using an Ohmmeter, check resistance of thermistor for a short or open condition.

If thermistor is shorted or open, replace it to return the system to normal operation. If fault is in the wiring connections, correcting the fault will clear the code and return the system to normal operation.

NOTE: If fault condition is an open thermistor or a wiring problem that appears to be an open thermistor and the power to the fan coil control is cycled off, the fault code will be cleared on the next power-up but the fault will remain and system operation will not be as expected. This is because on power-up, the fan coil

control cannot discern the difference between an open sensor or if a sensor is not installed.

F. Emergency Heating and Cooling Modes

Fan coil control can provide **emergency** heating or cooling using a common heat/cool thermostat in the event that there are no system communications, fault is in User Interface and no replacement is immediately available.

To activate these modes, the thermostat and outdoor unit must be wired as a common heating/cooling system to fan coil control RYWC terminals. Fan coil control must be powered and displaying Status Code 16, System Communication Fault.

NOTE: These emergency modes do not provide the level of comfort and efficiency expected by the consumer and should only be activated when User Interface cannot be replaced immediately.

FE4A FAN COIL SEQUENCE OF OPERATION

The FE4A fan coil is designed for installation with a communicating User Interface. This fan coil will not respond to commands provided by a common thermostat except under certain emergency situations described in the Start Up and Troubleshooting sub-section.

The User Interface uses temperature; humidity and other data supplied from indoor and outdoor system components to control heating or cooling system for optimum comfort.

FE4A ADVANCED TROUBLESHOOTING:

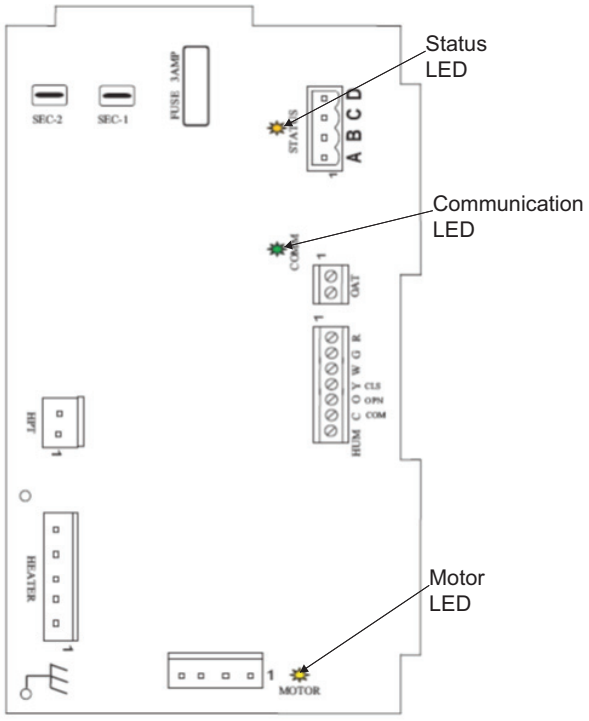

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Fig. 12 - FE4A Circuit Board LED Locations

Troubleshooting the FE Fan Coil Circuit Board:

-Production Unit circuit board Fan Coil part number HK38EA011

-RCD Replacement circuit board HK38EA012

-Older circuit board part numbers HK38EA006 and HK38EA009

Primary test that should be performed:

Motor Line Voltage Check

1. Turn off power (240V).
2. Remove Plug 3 from ECM motor
3. Turn on power.
4. Check Plug 3, terminals 4 and 5, to ensure there are 240V.
5. Turn off power.
6. Reconnect Plug 3 to motor.

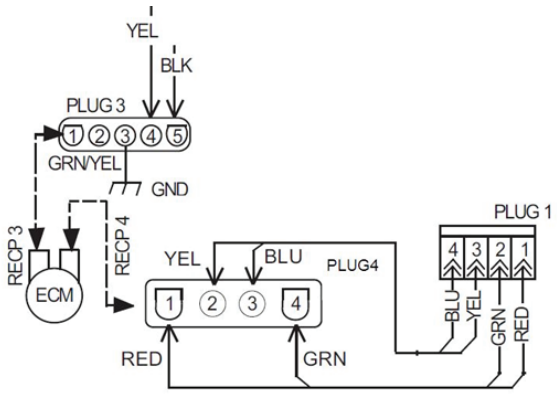

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Fig. 13 - FE4A ECM/Plug Wiring Diagram

The following troubleshooting techniques will assist in determining the correct component to replace when the Fan Coil Board (HK38AE011) presents a Fault Code 44 or 41:

1. Disconnect power from the unit (240V).
2. Disconnect the ABCD connector from the board.
3. Disconnect Plug 1 from the board (HK38AE011). (See Fig. 13.)
4. Turn on power (240 volts).
5. After reestablishing power, you should receive Fault Code 44, and the motor LED should be off.
6. Place a jumper across the R and G terminals on the low voltage terminal block
7. Fault Code 44 should still be flashing.
8. The Motor LED should be flashing, indicating the board is able to transmit a signal to the motor.
9. If Motor LED is not flashing, check to ensure that 24V is present across R and C on the low voltage terminal block and that there is a good connection with the R and G jumper.
10. If 24V is present and the jumper/connections are good,
11. Replace the board.

Check Board

12. If Fault Code 44 and the Motor LED are both flashing, place a DC voltmeter across terminals PL1-1 Red (+) to PL1-2 Green (-). (See Fig. 13.)
13. Across terminal PL1-1 and PL1-2, a 12-Vdc should be present. If 12Vdc is not present, replace circuit board (HK38AE011).
14. If Fault Code 44 is flashing and the Motor LED is flashing, place a DC voltmeter across terminal PL1-3 (+) and PL1-2 (-).
15. Across terminal PL1-3 (+) and PL1-2 (-), the DC volt meter should display 5Vdc. The voltage should be very stable and should not fluctuate more than .02Vdc. If the voltage fluctuates, get a different voltmeter before proceeding to the following steps.
16. Reconnect Plug 1 to circuit board (HK38AE011) and connect DC voltmeter across terminals PL1-3 Yellow (+) and PL1-2 Green (-). Does the voltage appear to fluctuate more than in step 15? Typical voltmeters will show a fluctuation of .2Vdc to 1Vdc. The amount of fluctuation is not important. You could see even more fluctuation depending on the voltmeter used.

17. Check the blower motor serial output signal. The blinking LED on the control board represents the serial output signal. You can measure the signal with a DC voltmeter by removing Plug 1 from the circuit board (HK38AE011) and connecting the DC voltmeter across PL1-4 (+) and PL1-2 (-). The voltage should be near 0Vdc but it will fluctuate briefly several times per second. If you have an analog voltmeter, the needle briefly will go high several times per second. If you have a digital voltmeter with a bar graph, it will show a large change in magnitude on the bar graph several times per second. If you have a plain, digital voltmeter, it will show a brief fluctuation in voltage, and the magnitude may vary depending on the voltmeter used.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect all power to the unit before servicing the field wires or removing the control package. The disconnect (when used) on the access panel does not disconnect power to the line side of the disconnect, but does allow safe service to all other parts of the unit.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary. An inspection port is provided on all A-coil delta plates. Remove plastic plug to inspect. Replace plug after inspection.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

FILTER ASSEMBLY

To clean or replace air filter, push plastic connectors toward center of unit and remove filter access panel outward. Push filter up and back into unit. Then slide filter out.

Clean filter by using cold water and mild detergent. Rinse and allow filter to dry. No oiling or coating of filter is required.
New filters are available from your local distributor. Place filter in slot with cross-mesh binding up or facing cooling coil and replace filter access panel.

COOLING COIL, DRAIN PAN, AND COND. DRAIN

The cooling coil is easily cleaned when it is dry. Inspect the coil and clean (if necessary) before each cooling season. To check or clean cooling coil, remove coil access panel. If coil is coated with dirt or lint, vacuum it with a soft brush attachment.

Be careful not to bend coil fins. If coil is coated with oil or grease, clean it with a mild detergent and water solution. Rinse coil thoroughly with clear water. Be careful not to splash water on insulation.

FFM

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before installation or servicing system, always turn off main power to system. There may be more than one disconnect switch. Turn off accessory heater power if applicable. Lock out and tag switch with a suitable warning label.

FAN MOTOR

The motor is three-speed direct drive. High-speed lead is black, medium-speed lead is red, low-speed lead is blue, and common lead is purple. Be sure proper blower speed has been selected.

The motor is turned on through two different routes. The first occurs when thermostat calls for the fan in cooling, heat pump, or fan-only mode. A 24-Vac signal is sent to relay, causing relay to close its normally open contacts, turning fan on.

The second occurs when there is a call for electric heat. A 24-Vac signal is sent to heater sequencer/relay, causing it to close, directing 230V through the normally closed contact of fan relay, turning fan on. The fan remains on until sequencer/relay opens.

If motor does run, test motor for an open winding or a winding shorted to motor case. If either is present, replace motor.

ELECTRIC HEATER SERVICE

Service can be completed with heater in place. Shut off power before servicing.

A. Limit Switch

Refer to Electric Heater Kit Function and Troubleshooting section of this manual.

B. Sequencer

Refer to Electric Heater Kit Function and Troubleshooting section of this manual.

C. Transformer

A 40-VA transformer supplies 24-V power for control circuit. Check for 208/230V on primary side of transformer. If present, check for 24V on secondary side.

NOTE: Transformer is fused. Do not short circuit.

D. Fan Relay

Relay coil is 24-V. Check for proper control voltage. Replace relay if faulty.

CLEANING OR REPLACING REFRIGERANT FLOW-CONTROL DEVICE

The FFM piston can be removed and cleaned if believed to be plugged. This unit's piston is unique and replacements are available from RCD.

The filter drier should be located on the liquid line at the indoor unit to prevent particulate from plugging the piston.

SEQUENCE OF OPERATION

A. Condensing Unit

COOLING

When thermostat calls for cooling, the circuit between R and G is complete and single-pole single-throw relay FR is energized. The normally open contacts close causing blower to operate.

The circuit between R and Y is also complete. This completed circuit causes contactor in outdoor unit to close which starts compressor and outdoor fan.

HEATING

When thermostat calls for heating and FAN switch is set on AUTO, the circuit between R and W is complete. The heater sequence SEQ

is energized which closes contacts of relay. There will be a time delay. This completed circuit energizes all heating elements HTR and blower motor.

B. Heat Pump

COOLING

On a call for cooling, the thermostat makes circuits R-O, R-Y, and R-G. Circuit R-O energizes reversing valve, switching it to cooling position. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor unit blower relay starting indoor blower motor.

When thermostat is satisfied, its contacts open de-energizing contactor reversing valve and blower relay. This stops compressor and fan motors.

HEATING

On a call for heating, the thermostat makes circuits R-Y and R-G. Circuit R-Y energizes contactor starting outdoor fan motor and compressor. Circuit R-G energizes indoor blower relay starting blower motor.

Should temperature continue to fall, R-W circuit is made through second-stage room thermostat bulb. Circuit R-W energizes a sequencer bringing on supplemental electric heat.

When thermostat is satisfied, its contacts open de-energizing contactor and sequencer. All heaters and motors should stop.

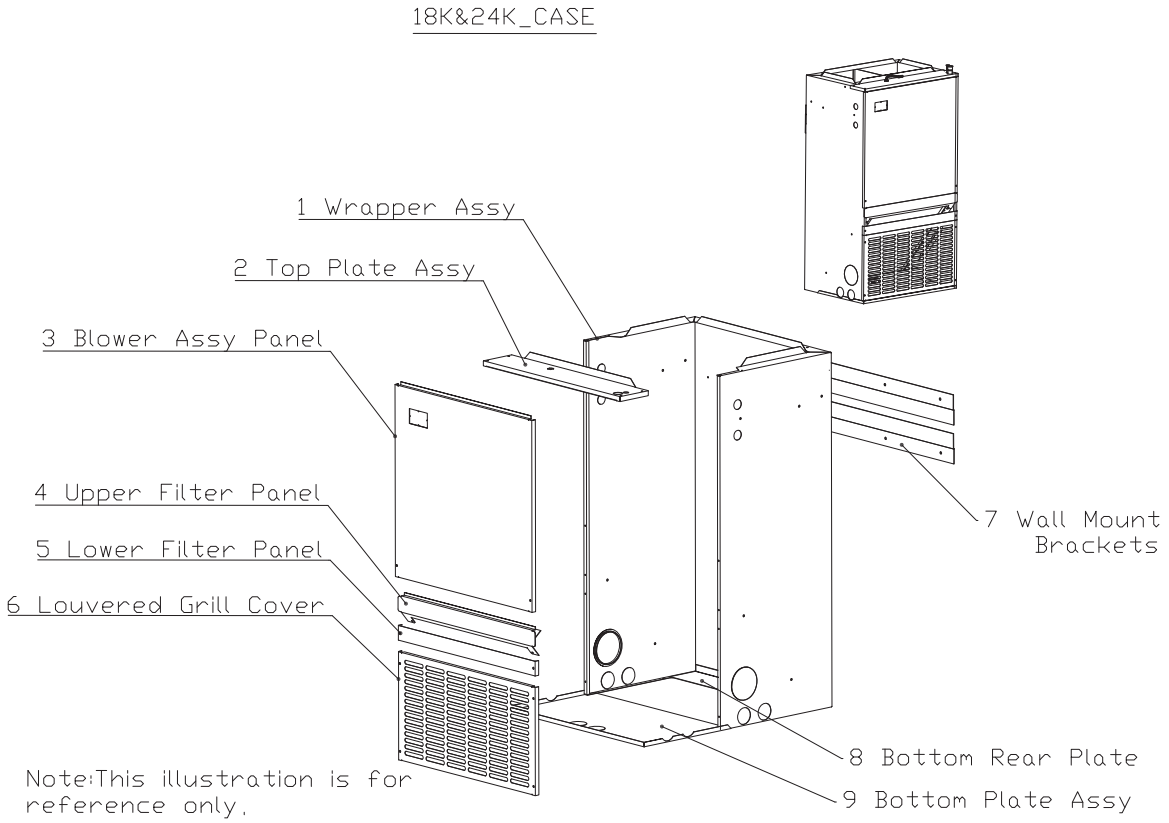

Fig. 14 - FFMA (sizes 18 & 24) Expanded View- Case

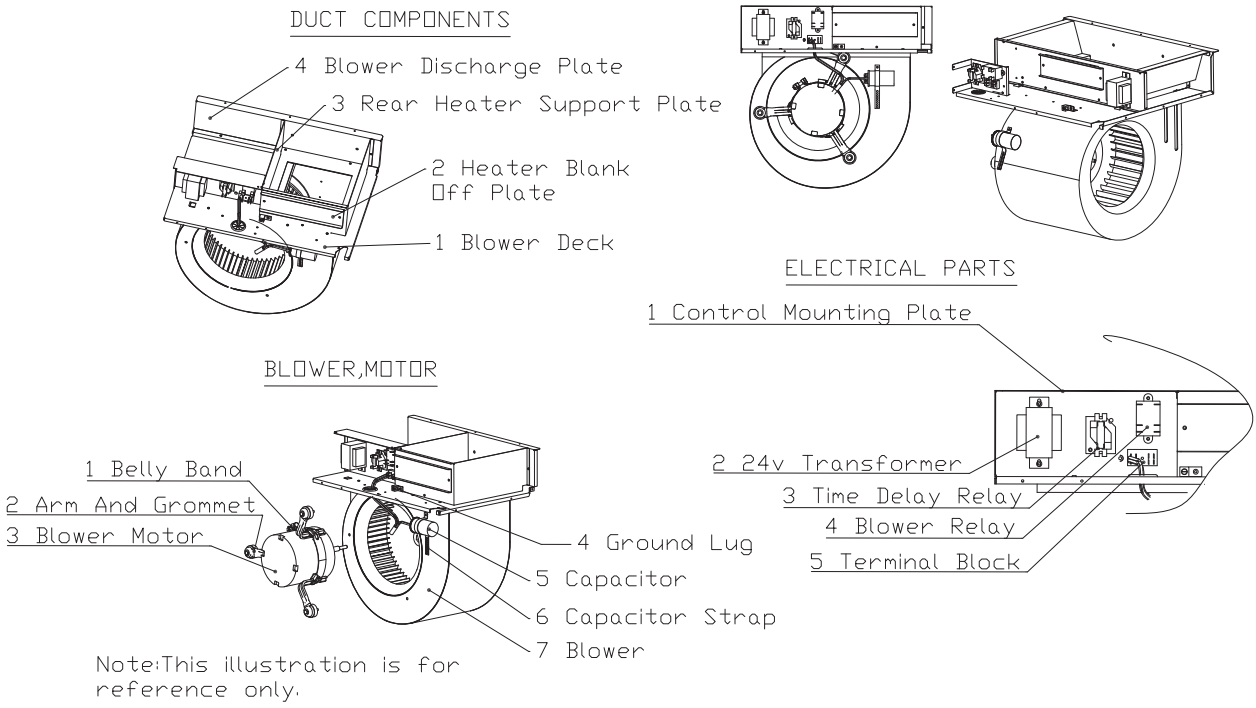

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Fig. 15 - FFMA (sizes 18 & 24) Expanded View- Duct Components, Blower & Electrical Parts

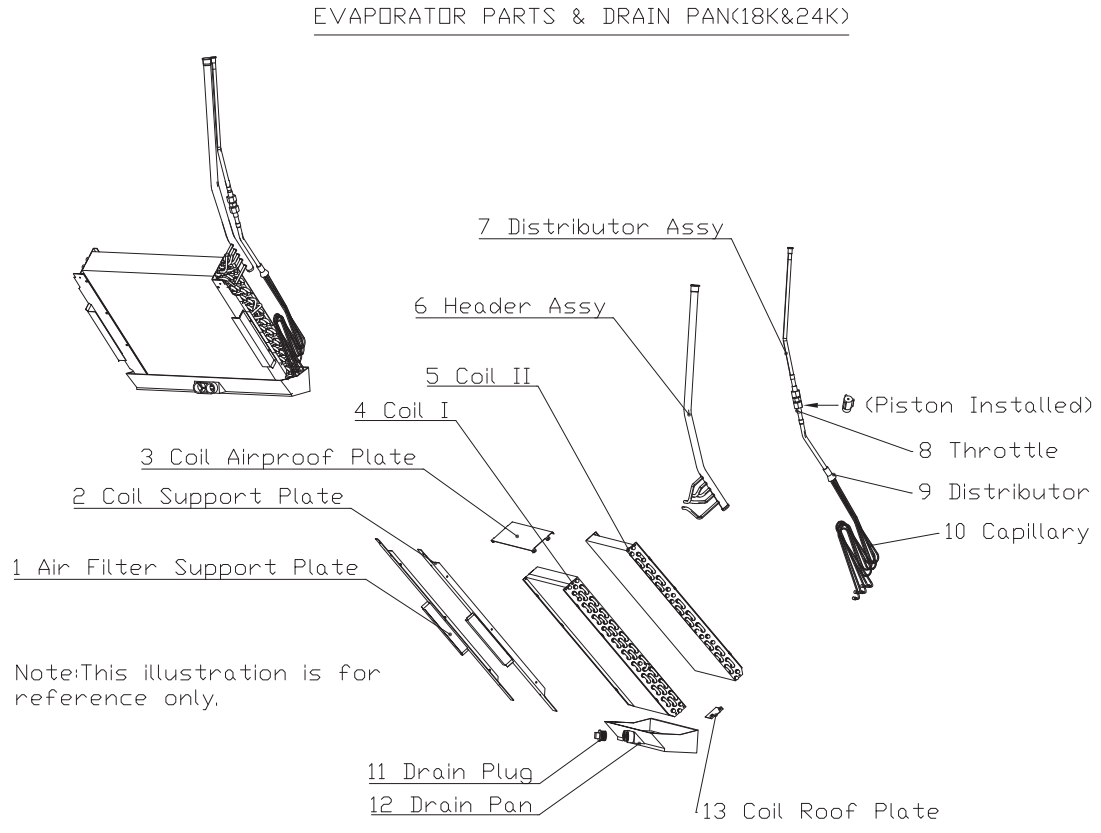

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Fig. 16 - FFMA (sizes 18 & 24) Expanded View- Evaporator Parts & Drain Pan

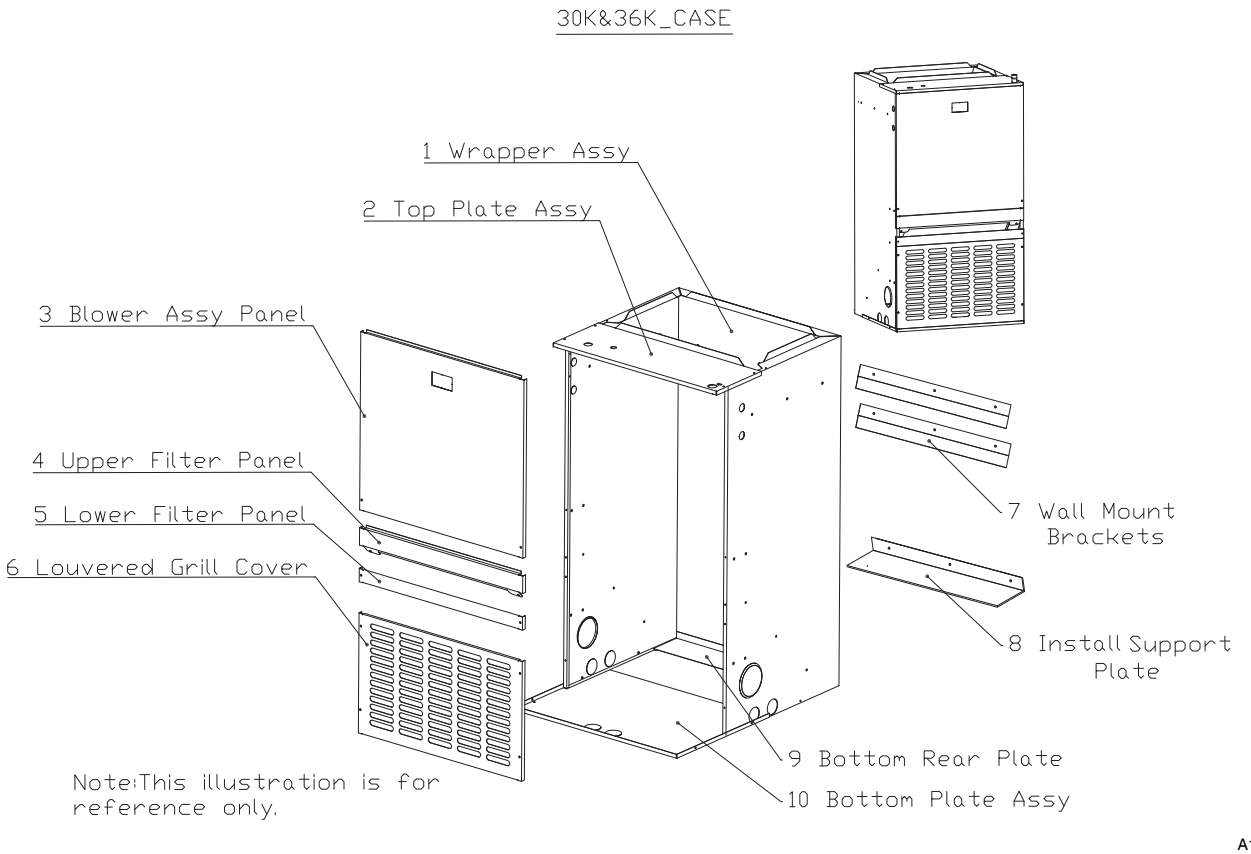

Fig. 17 - FFMA (sizes 30 & 36) Expanded View- Case

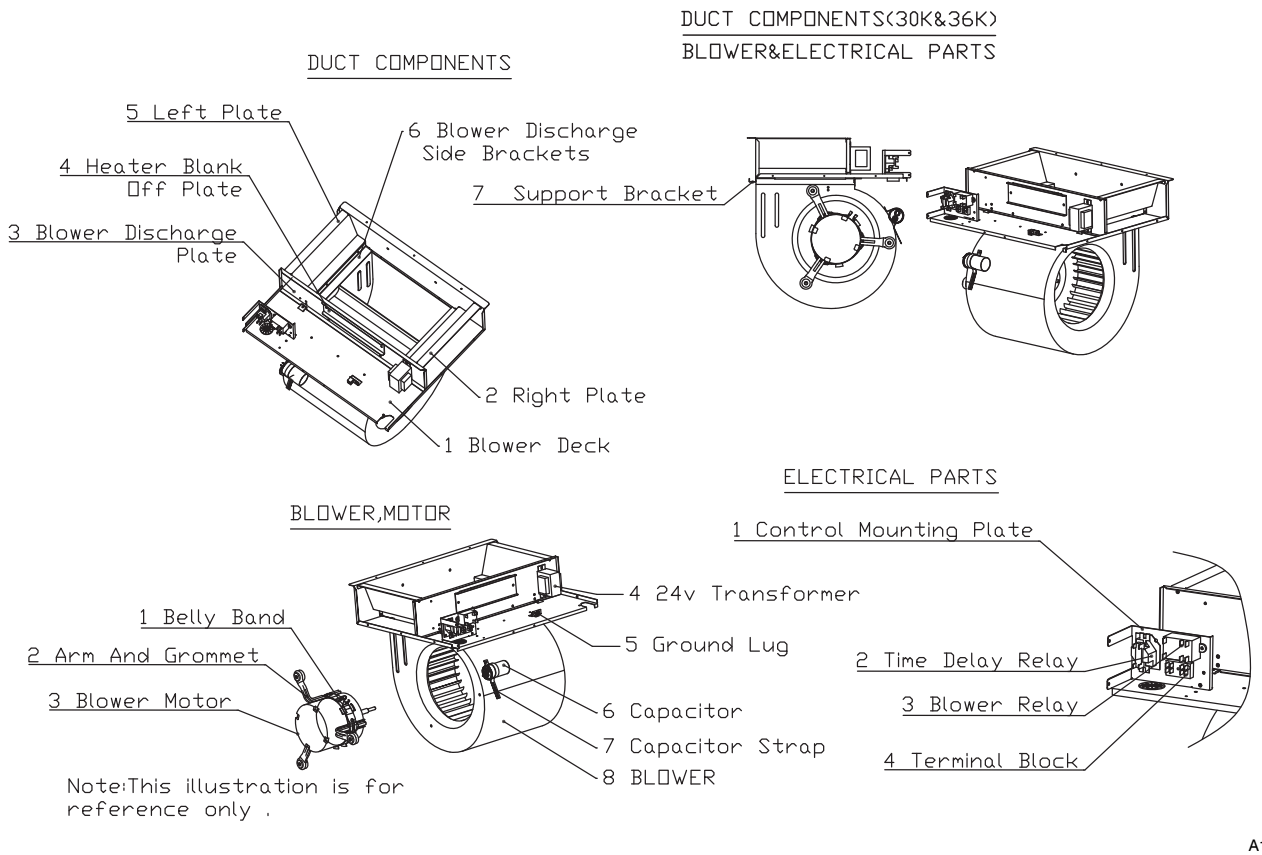

Fig. 18 - FFMA (sizes 30 & 36) Expanded View- Duct Components, Blower & Electrical Parts

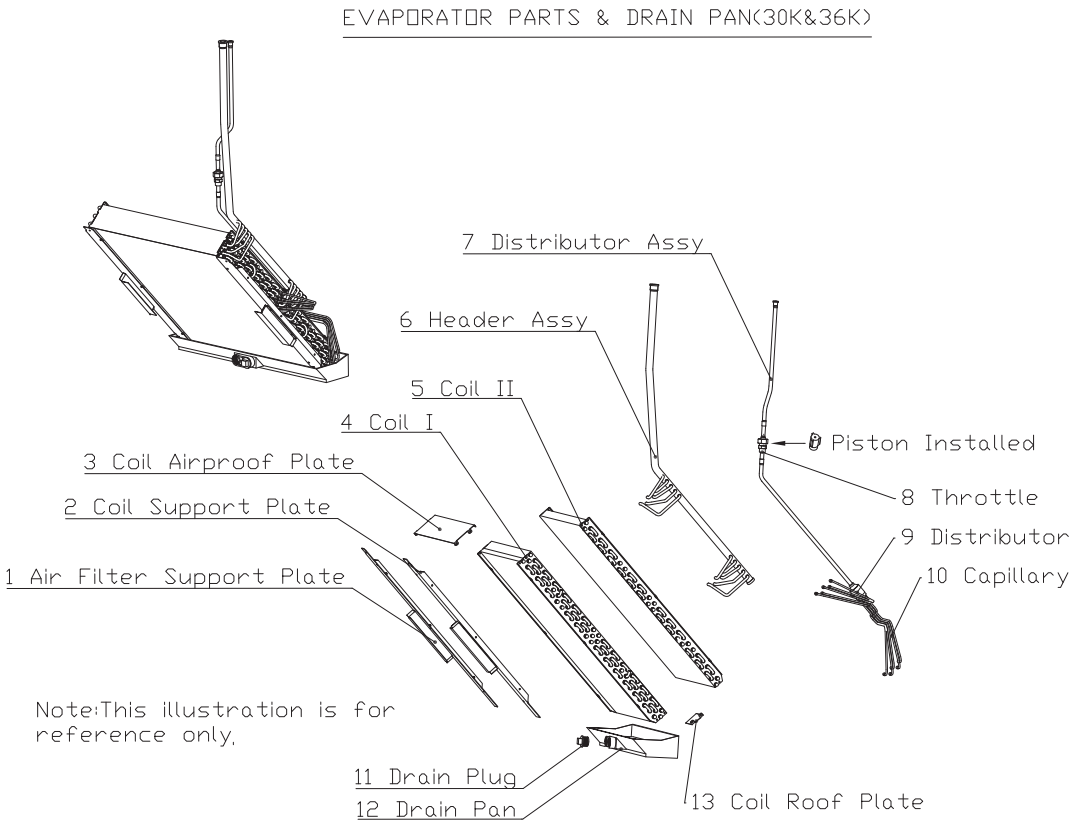

Fig. 19 - FFMA (sizes 30 & 36) Expanded View- Evaporator Parts & Drain Pan

ELECTRIC HEATER FUNCTION AND TROUBLESHOOTING

FB4, FE4, FF1E, FH4, FV4, FX4 and PF4

This section describes KFC, and KFD series electric heaters in exclusion of Smart Heat by examining the functional operation of these heaters.

DESCRIPTION OF ELECTRIC HEATER COMPONENTS

A. Limit Switch

The limit switch is a temperature sensitive control whose function is to prevent system from overheating in abnormal conditions. The temperature settings often vary from heater to heater due to variations in airflow patterns and element radiant heat conditions.

The devices are sized to remain on-line under heat pump conditions (115° air off coil) and minimum CFM, but trip to prevent outlet air conditions above 200° F or excessive component or duct temperatures.

The device itself consists of a bimetallic disc, which when overheated ”snaps through” to open a normally closed high-voltage, high-current switch. When system temperatures cool sufficiently, the switch will automatically reset to its closed position. Normal failure mode for this switch is open.

If a limit switch has been determined to be defective, NEVER BYPASS THE LIMIT SWITCH. When replacing limit switch, ensure that it is replaced with a limit switch of identical opening temperature and closing differential. Limit switches are typically color coded to identify their range.

B. KFC and KFD Electric Heat Relay

KFC and KFD electric heater packages have relays controlling the heater elements instead of sequencers. A small rectifier PCB is mounted to each relay which converts the incoming 24-Vac control signal to DC.

In addition to the rectifier circuit, the second and third stage relays contain a time-on delay circuit of five seconds for second stage, and eight seconds for third stage. When the control signal is removed from the relays, all relays will open with no time-off delay.

TROUBLESHOOTING KFC, AND KFD SERIES ELECTRIC HEATERS

A. Discolored Wire Insulation at Terminal

Check quick-connect terminal at discoloration. Connection may be loose, creating a high resistance through connection point.

B. Fuse Failure

1. Check for shorted wire. Replace wire. Never try to fix wire using electrical tape.
2. Check shorted element. If element is shorted, replace heater.

C. No Heat

1. Check fuse for failure. If fuse has failed, refer to Fuse Failure section.
2. Check for faulty transformer. Check output voltage of transformer secondary side R (red) and C (brown). Make sure output is between 18Vac and 30Vac. If output voltage is low and input voltage tests normal, replace transformer.
3. Check for miswired heater plug harness.
4. Check limit switch or sequencer failure. These switches should have failed in open position. If output voltage is zero volts, replace switch.
5. Check heater relay and PCB (KFC and KFD heaters only). Control voltage input to PCB should be 24Vac. Output to relay should be 18-Vdc minimum. If input is present but no output, replace PCB. If output is present, replace relay.

D. Heater Will Not Turn Off

1. Check low-voltage wiring for miswire.
2. Check for shorted elements to ground.
3. Replace sequencer/relays. They may be stuck closed.

E. Nuisance Trips

1. Check for low airflow due to dirty filters, blocked registers, or undersized duct.

2. Check blower motor and wheel for proper operation. Excessive current draw of motor will cause internal overload to trip.
3. The fan speed may be low.

FFM

This section describes EHK2 series electric heaters by examining functional operation of this heater.

Service can be completed with heater in place. Shut off power before servicing.

DESCRIPTION OF ELECTRIC HEATER COMPONENTS

A. Limit Switch

The limit switch is a temperature sensitive control that's function is to prevent system from overheating in abnormal conditions. The temperature settings often vary from heater to heater due to variations in airflow patterns and element radiant heat conditions.

The devices are sized to remain on-line under heat pump conditions (115° F air off coil) and minimum CFM, but trip to prevent outlet air conditions above 200° F or excessive component or duct temperatures. The device itself consists of a bimetallic disc, which when overheated "snaps through" to open a normally closed high-voltage, high-current switch. When system temperatures cool sufficiently, the switch will automatically reset to its closed position. Normal failure mode for this switch is open.

If a limit switch has been determined to be defective, NEVER BYPASS THE LIMIT SWITCH. When replacing limit switch, ensure that it is replaced with a limit switch of identical opening temperature and closing differential. Limits switches are typically color-coded to identify their range.

B. Sequencer

The sequencer is essentially a thermally-activated time-delay relay normally activated by low-voltage control signals from thermostat. The typical sequencer is a 1- or 2-pole normally open device which energizes within 30 to 70 seconds after application of control signal and de-energizes 60 to 90 seconds after control signal is removed.

In simplistic terms, the sequencers which we use are nothing more than normally open limit switches which sit on top of a small resistive heater. When voltage is applied to this heater, a positive temperature coefficient resistor (PTC), heat is supplied to a bimetallic disc which "snaps through" and closes switch.

The time required for PTC to heat to a sufficient point controls ON timing of device. The time required for disc to cool down when power is removed controls OFF time of device. The PTC can be varied to provide varied timing. Typically a short ON equates to a long OFF.

Because this is a thermally-activated device, ambient conditions affect the ON/OFF cycle. Higher ambient temperature means shorter ON times and longer OFF times.

Application of these devices is such that the first switch ON not only turns on first heater element, but also ensures that indoor fan is energized, because first ON is last OFF. This ensures fan remains ON until the last heater de-energizes.

CARE AND MAINTENANCE

FB4, FE4, FH4, FV4, FX4, and PF4

To continue high performance, and minimize possible equipment failure, it is essential periodic maintenance be performed on this equipment.

The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools. The only consumer service recommended or required is filter maintenance. (See Filter Assembly.)

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect all power to the unit before servicing the field wires or removing the control package. The disconnect (when used) on the access panel does not disconnect power to the line side of the disconnect, but does allow safe service to all other parts of the unit.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary. An inspection port is provided on all A-coil delta plates. Remove plastic plug to inspect. Replace plug after inspection.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

FILTER ASSEMBLY

To clean or replace air filter, push plastic connectors toward center of unit and remove filter access panel outward. Push filter up and back into unit. Then slide filter out.

Clean filter by using cold water and mild detergent. Rinse and allow filter to dry. No oiling or coating of filter is required.
New filters are available from your local distributor. Place filter in slot with cross-mesh binding up or facing cooling coil and replace filter access panel.

COOLING COIL, DRAIN PAN, AND CONDENSATE DRAIN

The cooling coil is easily cleaned when it is dry. Inspect the coil and clean (if necessary) before each cooling season. To check or clean cooling coil, remove coil access panel. If coil is coated with dirt or lint, vacuum it with a soft brush attachment.

Be careful not to bend coil fins. If coil is coated with oil or grease, clean it with a mild detergent and water solution. Rinse coil thoroughly with clear water. Be careful not to splash water on insulation.

Inspect drain pan and condensate drain at the same time cooling coil is checked. Clean drain pan and condensate drain by removing any foreign matter from pan. Flush pan and drain tube with clear water.

If drain tube is restricted, it can generally be cleared by high-pressure water. Cut plastic line and work outside condensate pan and away from coil to clean drain tube.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Do not use caustic household drain cleaners in the condensate pan or near the coil. Drain cleaners can quickly destroy a coil.

BLOWER MOTOR AND WHEEL

Clean blower motor and wheel when cooling coil is cleaned.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect electrical power before removing any access panels. Lock out and tag switch with a suitable warning label.

To clean blower motor or blower wheel:

1. Remove blower access panel.
2. Remove motor leads from fan coil control. Note lead location for ease of reassembly.
3. Remove the two outside screws holding blower/motor assembly against blower deck flange and slide assembly out of cabinet.
4. (If applicable) Remove screw in strap holding motor capacitor to blower housing and slide capacitor out from under strap. Remove screw with green wire from blower housing. Mark blower wheel, motor, and motor support in relation to blower housing before disassembly to ensure proper reassembly. Note position of blades on wheel.
5. Loosen setscrew holding blower wheel onto motor shaft.
6. Remove the three bolts holding motor mount to blower housing and slide motor and mount out of housing. Further disassembly should not be necessary as adequate clearance is available.
7. Remove blower wheel from housing by removing cutoff plate from blower housing outlet. Note wheel orientation and cutoff location for reassembly. The blower motor and wheel may be cleaned by using a vacuum with a soft brush attachment.
8. Remove grease with a mild solvent such as hot water and detergent. Be careful not to disturb balance weights (clips) on blower-wheel vanes. Also, do not drop or bend wheel, as balance will be affected.

To reassemble blower:

1. Place blower wheel back into housing. Be sure to position correctly for proper location.
2. Reassemble cutoff plate to housing using identified holes from disassembly procedure.
3. Position motor and mount in same position as when blower housing was in unit. Secure motor mount on housing, using removed bolts. Make sure mount or motor is grounded to blower housing.
4. Locate blower wheel setscrew over flat on motor shaft. Rotate wheel in housing. It should not rub housing and should be centered in inlet opening. If not, loosen setscrew and align as necessary.
5. Attach green wire to blower housing with screw.
6. (If applicable). Secure motor capacitor under strap and tighten strap screw.
7. Slide blower assembly to blower deck. Be sure (once blower is within the unit casing) to force blower assembly toward control box while sliding assembly into unit to ensure that blower assembly engages deck properly.
8. Fasten blower assembly to deck with screws previously removed.
9. Reconnect electrical leads to fan coil control.
10. Reconnect electrical power to unit and test fan for proper rotation.

FF1E and FFMA

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

A. Air Filter

The air filter should be replaced as needed.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Never operate unit without a filter.

B. Cooling Coil, Drain Pan, and Condensate Drain

The cooling coil is easily cleaned when it is dry. Inspect coil and clean (if necessary) before each cooling season. To check or clean cooling coil, remove blower/heater access panel to gain full access to cooling coil. If coil is coated with dirt or lint, vacuum with a soft brush attachment.

Be careful not to bend coil fins. If coil is coated with oil or grease, clean it with a mild detergent and water solution. Rinse coil with clear water.

Be careful not to splash water onto insulation.

Inspect drain pan and condensate drain at same time cooling coil is checked. Clean drain pan and condensate drain by removing any foreign matter from pan. Flush pan and drain tube with clear water.

If drain tube is restricted, it can generally be cleared by high-pressure water. Cut plastic line and work outside condensate pan and away from coil to clear drain tube.

NOTE: There MUST be a trap in condensate line. Trap must be at least 3-in. deep, not higher than the bottom of unit condensate drain opening, and pitched downward to an open drain or sump.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

Do not use caustic household drain cleaners in the condensate pan or near the coil. Drain cleaners can quickly destroy a coil.

C. Blower Motor and Wheel

Clean blower motor and wheel when cooling coil is cleaned.

To clean or service wheel or motor, proceed as follows:

1. Pull unit disconnect (when used) and remove blower access panel.
2. Disconnect motor electrical leads from control box and capacitor. Mark location of wires for reassembly.
3. Remove the three bolts holding motor mount to blower housing while supporting motor shell with hand.
4. Pull motor inlet ring and blower wheel assembly out of blower housing.
5. With blower wheel, inlet ring, and motor mount still attached to motor, place motor on flat, horizontal surface, shaft up. Mark position of wheel on motor shaft for reassembly.
6. Loosen blower wheel setscrew and remove blower wheel from motor shaft.

NOTE: Further disassembly of motor and mount is not necessary as adequate clearance is available to clean motor.

7. Clean blower motor and wheel using a vacuum with a soft brush attachment. Remove grease with a mild solvent such as hot water and detergent. Be careful not to disturb balance weights (clips) on blower wheel vanes. Do not drop or bend wheel as balance will be affected.

To reassemble unit, proceed as follows:

1. Place motor with mount attached on flat, horizontal surface with shaft up.
2. Set inlet ring on top of motor mount grommets. Center inlet ring flush on all three grommets.
3. Slide blower wheel onto motor shaft with setscrew upward and aligned with shaft flat portion. Vertically position wheel along shaft to position marked during disassembly.

NOTE: If previous shaft was not marked or if replacing previous motor, set blower wheel position by sliding blower wheel along motor shaft to 1-1/8-in. above rubber grommets. (See Fig.20.)

4. Hold blower wheel in place and carefully tighten setscrew.
5. Position motor and blower wheel assembly to blower housing as originally oriented.
6. Secure motor mount to blower housing using bolts previously removed.
7. Attach green wire to blower housing with screw.
8. Connect electrical and capacitor leads to original terminals.
9. Replace blower access door and tighten all four screws.
10. Reinsert disconnect pullout only after blower access door is secured. Test blower for proper operation.

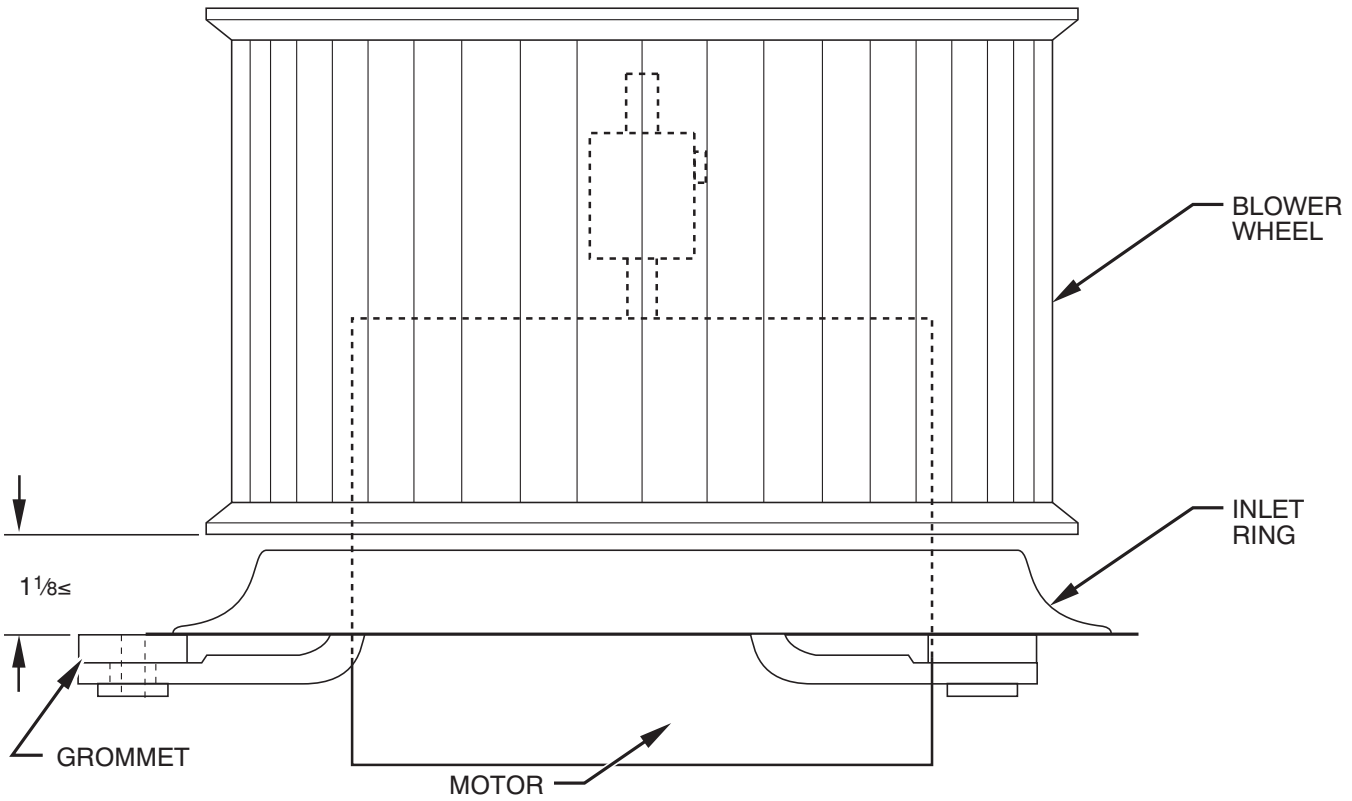

Fig. 20 - Motor, Inlet Ring, and Blower Wheel Assembly

REFRIGERANT FLOW-CONTROL DEVICES

THERMOSTATIC EXPANSION VALVES (TXV)

The FX4, FV4, FF1E and FE4 Fan Coils are factory equipped with a hard shutoff (HSO) TXV. The hard shutoff TXV has no bleed port and allows no bleed-through after system is shutdown.

The TXV is a bi-flow metering device that is used in condensing and heat pump systems to adjust to changing load conditions by maintaining a preset superheat temperature at outlet of evaporator coil. The volume of refrigerant metered through valve seat is dependent upon the following:

1. Superheat temperature sensed by sensing bulb on suction tube at outlet of evaporator coil. As long as this bulb contains some liquid refrigerant, this temperature is converted into pressure pushing downward on the diaphragm, which opens the valve via push rods.
2. The suction pressure at outlet of evaporator coil is transferred via the external equalizer tube to underside of diaphragm.

The bi-flow TXV is used on split system heat pumps. In cooling mode, TXV operates the same as a standard TXV previously explained. However, when system is switched to heating mode of operation, refrigerant flow is reversed.

The bi-flow TXV has an additional internal check valve and tubing. These additions allow refrigerant to bypass TXV when refrigerant flow is reversed with only a 1-psig to 2-psig pressure drop through device.

When heat pump switches to defrost mode, refrigerant flows through a completely open (not throttled) TXV. The bulb senses the residual heat of outlet tube of coil that had been operating in heating mode (about 85° F and 155 psig). This temporary, not-throttled valve decreases indoor pressure drop, which in turn increases refrigerant flow rate, decreases overall defrost time, and enhances defrost efficiency.

PROBLEMS AFFECTING TXV

A. Low Suction Pressure

1. Restriction in TXV
2. Low refrigerant charge
3. Low indoor load
4. Low evaporator airflow

B. High Suction Pressure

1. Overcharging
2. Sensing bulb not secure to vapor tube
3. High indoor load
4. Large evaporator face area

NOTE: When installing or removing TXV, wrap TXV with a wet cloth. When reattaching TXV, make sure sensing bulb is in good thermal contact with suction tube.

5. The needle valve on pin carrier is spring-loaded, which also exerts pressure on underside of diaphragm via push rods, which closes valve. Therefore, bulb pressure equals evaporator pressure at outlet of coil plus spring pressure. If load increases, temperature increases at bulb, which increases pressure on topside of diaphragm, which pushes pin carrier away from seal, opening valve and increasing flow of refrigerant. The increased refrigerant flow causes increased leaving evaporator pressure which is transferred via the equalizer tube to underside of diaphragm, with which the pin carrier spring pressure closes valve. The refrigerant flow is effectively stabilized to load demand with negligible change in superheat.

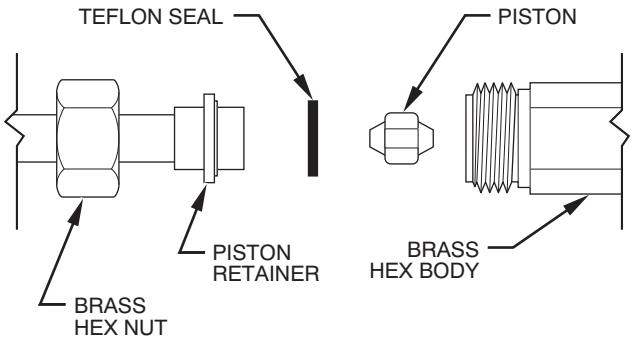

Fig. 21 - Refrigerant Flow-Control Device (For FB)

PISTON BODY CLEANING AND REPLACEMENT

⚠ CAUTION

ENVIRONMENTAL HAZARD

Failure to follow this caution may result in environmental damage.

Do not vent refrigerant to atmosphere. Recover during system repair or final unit disposal.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution could result in equipment damage.

Damage may occur to the scroll compressor if operated at a negative suction pressure during a system pumpdown.

1. Pump down outdoor unit. Close service valves at outdoor unit.
2. Recover remaining refrigerant from tubing and coil through gage port on vapor-tube service valve. Disconnect refrigerant (liquid) tube from piston body. (See Fig. 21.)
3. Avoid damaging seal ring or machined surfaces on piston, bore, and retainer.
4. Using small wire with a hook on end of it, remove piston from body.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution could result in equipment damage.

When cleaning the piston orifice, be careful not to scratch or enlarge the opening, as this will affect operation.

5. Install new or cleaned piston into body.
6. Replace seal ring on retainer.
7. Reconnect refrigerant tube to piston body.
8. Pressurize tubing and coil, then leak check.
9. Evacuate tubing and coil as necessary.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution could result in equipment damage.

Use a backup wrench and do not over tighten, as deformation of the piston body will occur, causing the piston to lodge in a partially open or closed position.

LIQUID TUBE STRAINER

In R-22 units, the TXV and refrigerant flow-control device is protected on the indoor coil by a wire mesh strainer. It is located inside the 3/8-in. liquid tube at field braze joint just outside unit casing. Access to strainer is through field braze joint.

COIL & CONDENSATE PAN REMOVAL AND REPLACEMENT (FB4, FE4, FX4 AND FV4)

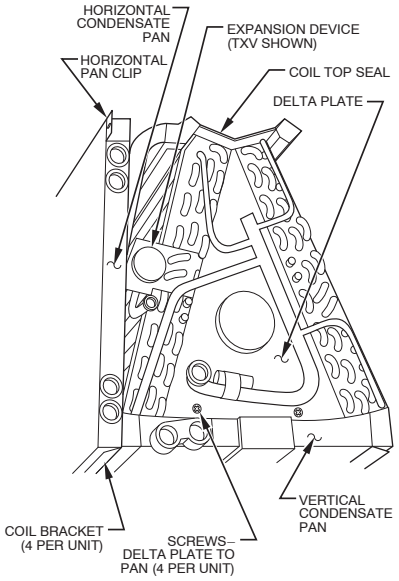

Fig. 22 - A-Coil Component Location

A-Coil Units

If it is determined that system does not have leaks and refrigerant is not contaminated, proceed as follows:

1. Recover system refrigerant.
   a. Attach manifold/gage set to service valves.
   b. Front seat (close) liquid tube service valve.
   c. Start unit in cooling mode.
   d. Run unit until low pressure switch opens (350kPa) or vapor pressure reaches 5 psig (35kPa). Do not allow compressor to pump into a vacuum.
   e. Turn off electrical supply to outdoor unit.
   f. Front seat (close) vapor service valve.
   g. Recover any remaining refrigerant.

NOTE: All outdoor unit coils will hold only factory-supplied amount of refrigerant. Excess refrigerant, such as in long-line applications, may cause compressor internal pressure relief valve to open (indicated by sudden rise in vapor pressure) before vapor pressure reaches 5 psig (35kPa). If this occurs, turn off electrical supply to outdoor unit immediately, front seat vapor service valve, and recover any remaining refrigerant.

2. Turn off electrical supply to indoor unit.
3. Disconnect condensate drain tube.
4. Disconnect liquid and vapor tubes from indoor coil. Use a tubing cutter to cut tubes.

NOTE: If a torch is used to unbraze tube set, protect fitting panel with a wet cloth or braze shield, as necessary.

5. Remove coil access panel.
6. Remove clip securing fitting panel to condensate drain pan. Remove fitting panel.
7. Remove any shipping clips, including horizontal pan clip, and slide coil/condensate pan assembly out of unit.
8. **Upflow or Horizontal Applications Only**—Remove horizontal condensate drain pan from coil/condensate pan assembly. (See Fig. 22.)
9. Remove the four coil brackets. (See Fig. 22.)
10. Remove screws at delta plates and remove coil from vertical condensate drain pan. (See Fig. 22.)
11. **Horizontal Applications Only**—Remove coil top seal (attached with four screws) and J-shaped tube from original coil and install it in same position on new coil. (See Fig. 22.)
12. Place coil assembly in plastic condensate pan and secure using four screws through delta plate. (See Fig. 22.)
13. **Horizontal and Upflow Applications Only**—Attach the four coil brackets to coil/pan assembly. (See Fig. 22.)
14. **Horizontal Applications only**—Place horizontal condensate pan into position on coil/pan assembly.

NOTE: Installation of horizontal condensate pan is not necessary for upflow or downflow applications.

15. Slide complete assembly into unit.
16. Reinstall fitting panel and reconnect clip securing fitting panel to condensate drain pan.
17. **Horizontal Applications Only**—Reinstall horizontal pan clip. Secure with one screw. (See Fig. 22.) Reinstall coil access panel.
18. Reconnect liquid and vapor refrigerant tubes, and condensate drain tube. Install new Puron (R-410A) liquid line filter-drier.
19. Evacuate tube set and indoor coil to 500 microns, back seat (open) liquid and vapor service valves.
20. Turn on electrical supplies to indoor and outdoor units.
21. Check system refrigerant charge and operation. See "Application Guideline and Service Manual for R-410A" for further information.

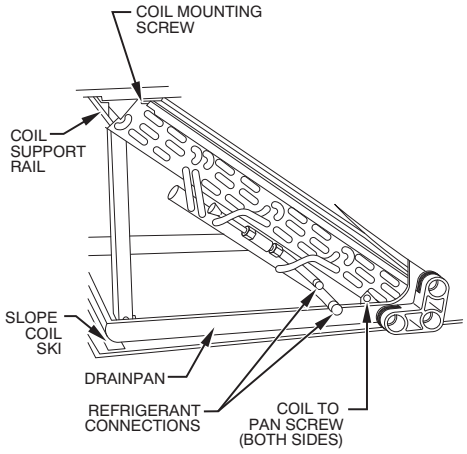

Fig. 23 - Slope Coil Component Location

SLOPE COIL UNITS

If it is determined that system does not have leaks and refrigerant is not contaminated, proceed as follows:

1. Recover system refrigerant.
   a. Attach manifold/gage set to service valves.
   b. Front seat (close) liquid tube service valve.
   c. Start unit in cooling mode.
   d. Run unit until low pressure switch opens at 50 psig (350kPa) or vapor pressure reaches 5 psig (35kPa). Do not allow compressor to pump into a vacuum.
   e. Turn off electrical supply to outdoor unit.
   f. Front seat vapor service valve.
   g. Recover any remaining refrigerant.

NOTE: All outdoor unit coils will hold only factory-supplied amount of refrigerant. Excess refrigerant, such as in long-line applications, may cause compressor internal pressure relief valve to open (indicated by sudden rise in vapor pressure) before vapor pressure reaches 5 psig (35kPa). If this occurs, turn off electrical supply to outdoor unit immediately, front seat vapor service valve, and recover any remaining refrigerant.

2. Turn off electrical supply to indoor unit.
3. Disconnect condensate drain tube.
4. Disconnect liquid and vapor tubes from indoor coil. Use either a tubing cutter to cut tubes or a torch to unbraze tubes as required.

NOTE: If a torch is used to unbraze line set, protect fitting panel with a wet cloth or braze shield, as necessary. System contains oil vapors which may ignite when exposed to a flame.

5. Remove coil access and fitting panels.
6. Remove 1 screw securing coil to unit casing.
7. Remove coil/pan assembly from unit.
8. Place assembly on a flat surface. Remove the two screws securing coil support columns to pan. (See Fig. 23.)
9. Rotate columns 90°, pull away from coil, and remove columns from assembly.
10. Remove the remaining two screws securing coil to condensate pan.
11. Remove coil from condensate pan.
12. Remove coil top seal. (See Fig. 23.)
13. Install new coil into condensate pan using the two original screws and two support columns.

NOTE: Correct coil position in condensate pan is essential to reliable operation.

14. Install new coil/pan assembly into unit. Secure with the two screws previously removed from unit casing.
15. Reinstall coil access and fitting panels.
16. Reconnect liquid and vapor refrigerant tubes, and condensate drain tube. Install new Puron (R-410A) liquid line filter-drier.
17. Evacuate tube set and indoor coil to 500 microns, back seat (open) liquid and vapor service valves.
18. Turn on electrical supplies to indoor and outdoor units.
19. Check system refrigerant charge and operation. See "Application Guideline and Service Manual for R-410A" for further information.

R-410A QUICK REFERENCE GUIDE

- R-410A refrigerant operates at 50-70 percent higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with R-410A refrigerant.
- R-410A refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- R-410A refrigerant systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low-side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- R-410A refrigerant, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid-line filter driers with rated working pressures less than 600 psig.
- Do not leave R-410A refrigerant suction line filter driers in line longer than 72 hours.
- Do not install a suction-line filter drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory approved liquid-line filter drier is required on every unit.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent R-410A refrigerant into the atmosphere.
- Observe all **warnings**, **cautions**, and **bold** text.

Edition Date: 01/13
Catalog No: SM-FANCOIL-01
Replaces: 03FA-4A6

FV4C
002, 003, 005, 006

Fan Coil for Puron® Refrigerant

Installation Instructions

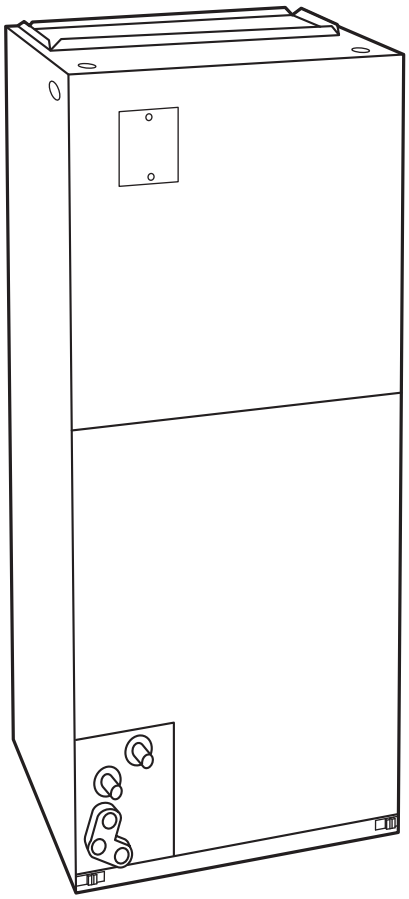

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Fig. 1 - Model FV4C

NOTE: Read the entire instruction manual before starting the installation.

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warning or cautions included in literature and attached to the unit. Consult local building codes and the current editions of the National Electrical Code (NEC) NFPA 70.

In Canada, refer to the current editions of the Canadian Electrical Code CSA C22.1.

Recognize safety information. When you see this symbol ⚠ on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand the signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTE**. These words are used with the safety-alert symbol. **DANGER** identifies the most serious hazards which **will** result in severe personal injury or death. **WARNING** signifies hazards which **could** result in personal injury or death. **CAUTION** is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Tag disconnect switch with a suitable warning label. Turn off accessory heater power if applicable.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

INTRODUCTION

Model FV4C Fan Coil units are designed for flexibility and can be used for upflow, horizontal, or downflow (kits required on manufactured and mobile home) applications. These units are designed specifically for Puron® refrigerant (R-410A) and must be used only with Puron air conditioners and heat pumps as shipped.

These units are designed to meet the low air leak requirements currently in effect. Because of this, the units need special attention in the condensate pan and drain connection area and when brazing tubing.

These units are available for application in systems of 18,000 through 60,000 Btuh nominal cooling capacities. Factory-authorized, field-installed electric heater packages are available in 5 through 30 kW. See Product Data for available accessory kits.

INSTALLATION

Procedure 1 — CHECK EQUIPMENT

Unpack unit and move to final location. Remove carton taking care not to damage unit.

Inspect equipment for damage prior to installation. File claim with shipping company if shipment is damaged or incomplete. Locate unit rating plate which contains proper installation information. Check rating plate to be sure unit matches job specifications.

Procedure 2 — MOUNT FAN COIL

Unit can stand or lie on floor, or hang from ceiling or wall. Allow space for wiring, piping, and servicing unit.

IMPORTANT: When unit is installed over a finished ceiling and/or living area, building codes may require a field-supplied secondary condensate pan to be installed under the entire unit. Some localities may allow the alternative of running a separate, secondary condensate line. Consult local codes for additional restrictions or precautions.

When installing any fan coil over a finished ceiling and/or living area, installation of a secondary drain pan under entire unit to avoid damage to ceiling is recommended.

FV4C Fan Coils can be installed for upflow and horizontal-left applications as factory shipped. Units can be installed for horizontal-right applications with field modifications. Units may be converted for downflow applications using factory-authorized accessory kits.

NOTE: To ensure proper drainage for horizontal installations, unit must be installed so it is within 1/8 in. (3.2mm) level of the length and width of unit.

A. Upflow Installation

If return air is to be ducted, install duct flush with floor. Set unit on floor over opening. Only use return-air opening provided. All return air must pass through the coil. (See Fig. 2.)

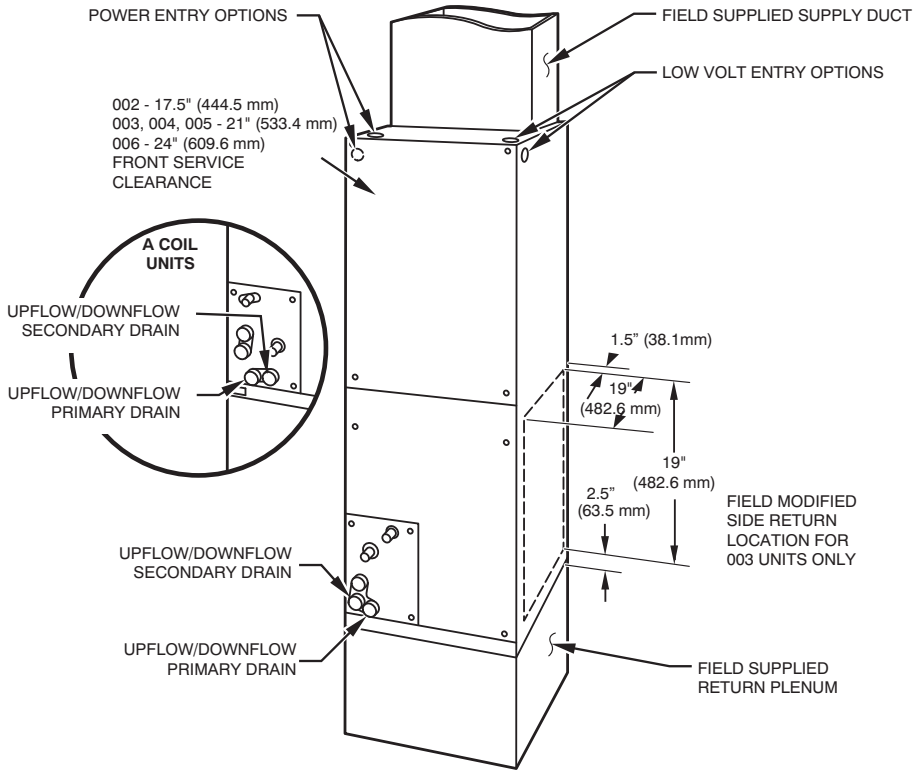

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Fig. 2 - Slope Coil Unit in Upflow Application

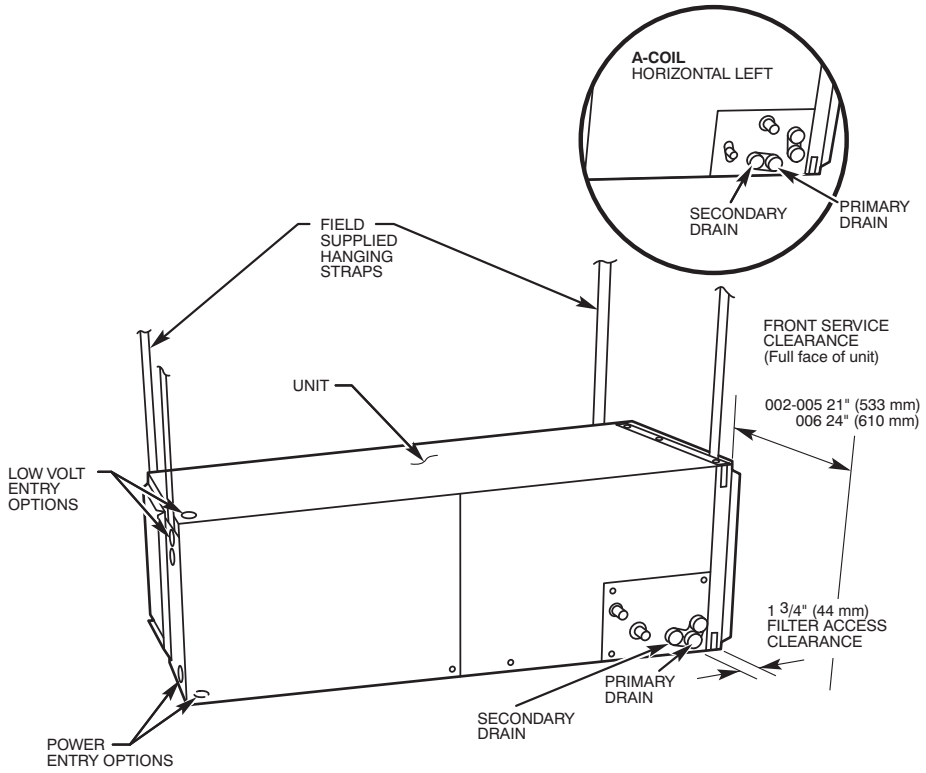


Fig. 3 - Slope Coil in Horizontal-Left Application (Factory Ready)

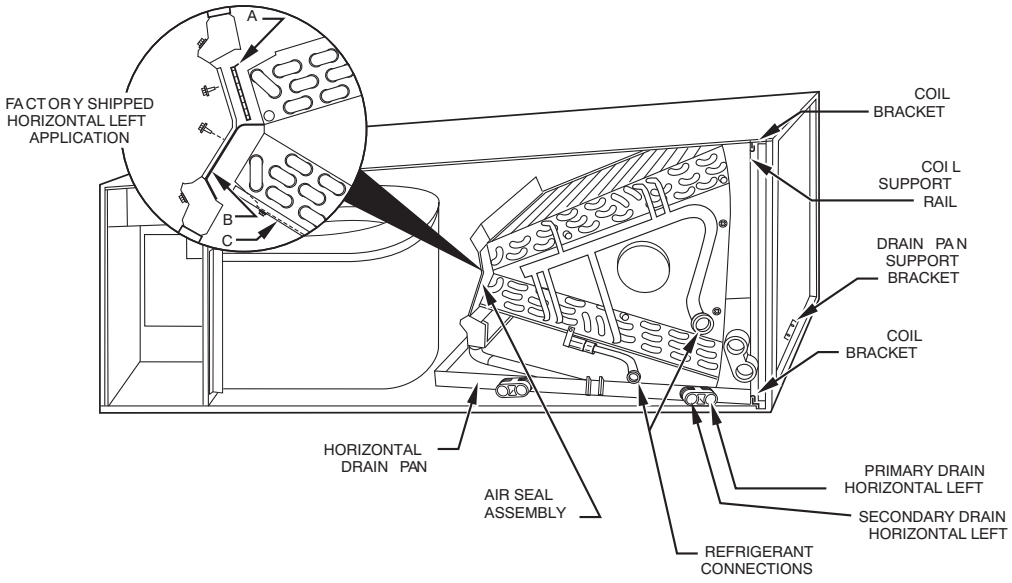


Fig. 4 - A-Coil in Horizontal-Left Application (Factory Ready)

B. Modular Units

The FV4C Fan Coil in sizes 003, 005 and 006 are available in 2-piece modular construction. Modular construction allows installer to disassemble unit into 2 components, coil box and blower box, for ease of installation. (See Fig. 3.)

To disassemble unit, remove rear corner brackets by removing 2 screws which secure brackets. Remove either 2 screws in each front corner of coil box, or 2 screws in blower box. Do not remove all 4 screws in each corner. Sections may now be separated by lifting top section from lower section.

To reassemble, reverse above procedure. Be certain to reinstall all fasteners when reassembling.

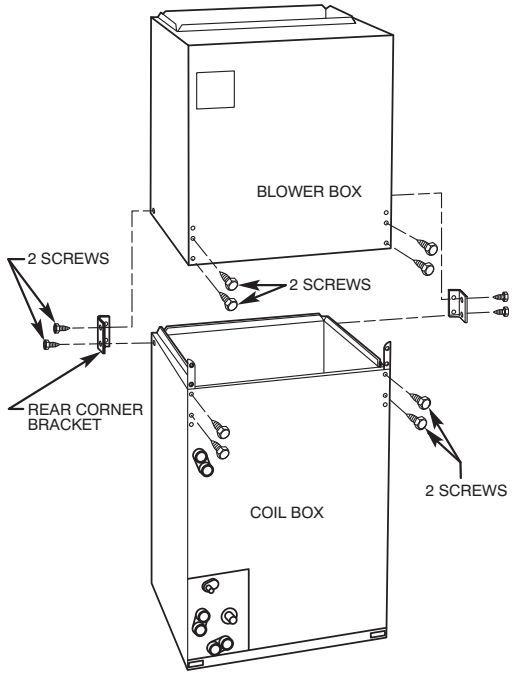


Fig. 5 - Modular Unit Assembly

C. Horizontal Installations

Be sure installation complies with all applicable building codes that may require installation of a secondary condensate pan.

1. Arrange support for unit by setting it in or above secondary condensate pan.
2. When suspending unit from ceiling dimples in casing indicate proper location of screws for mounting metal support straps. (See Fig. 4.)

D. Horizontal-Right Conversion of Units with Slope Coils

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in property damage.

Gasket kit number KFAHD0101SLP is required for horizontal slope coil conversion to maintain low air leak/low sweat performance.

1. Remove blower and coil access panels and fitting panel. (See Fig. 5.)
2. Remove screw securing coil assembly to right side casing flange.
3. Remove coil assembly.
4. Lay fan coil on its right side and reinstall coil assembly with condensate pan down. (See Fig. 5.)
5. Attach coil to casing flange using previously removed coil mounting screw.
6. Make sure the pan cap in the fitting door is properly seated on the fitting door to retain the low air leak rating of the unit.
7. Add gaskets from kit KFAHD per kit instructions.
8. Reinstall access panels and fitting panel, aligning holes with tubing connections and condensate pan connections.

Make sure liquid and suction tube grommets are in place to prevent air leaks and cabinet sweating. Install grommets after brazing.

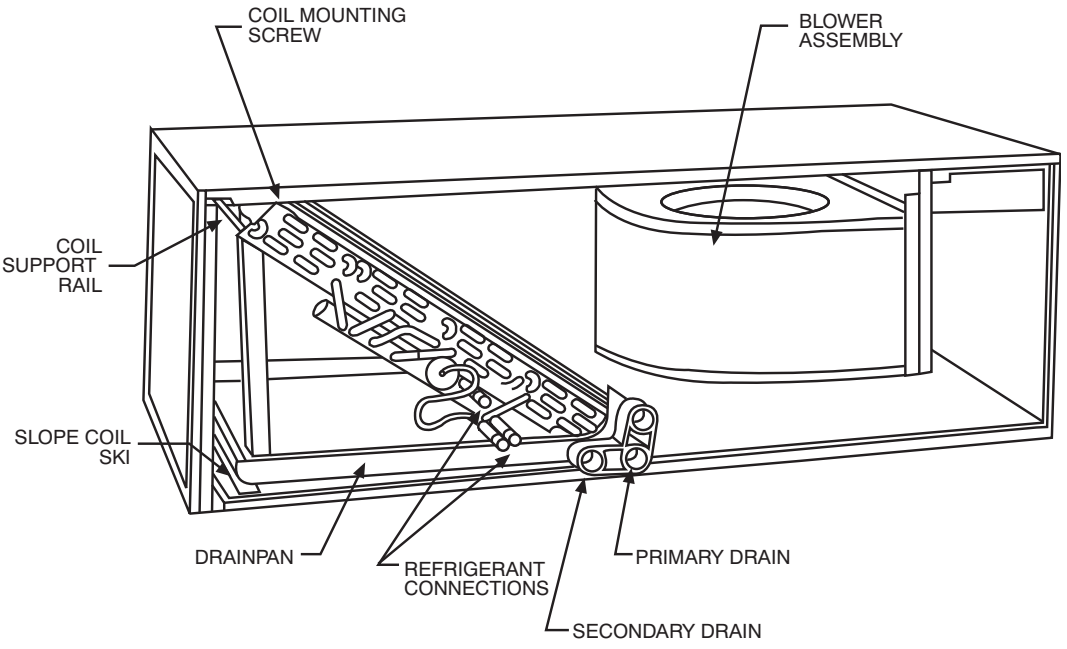
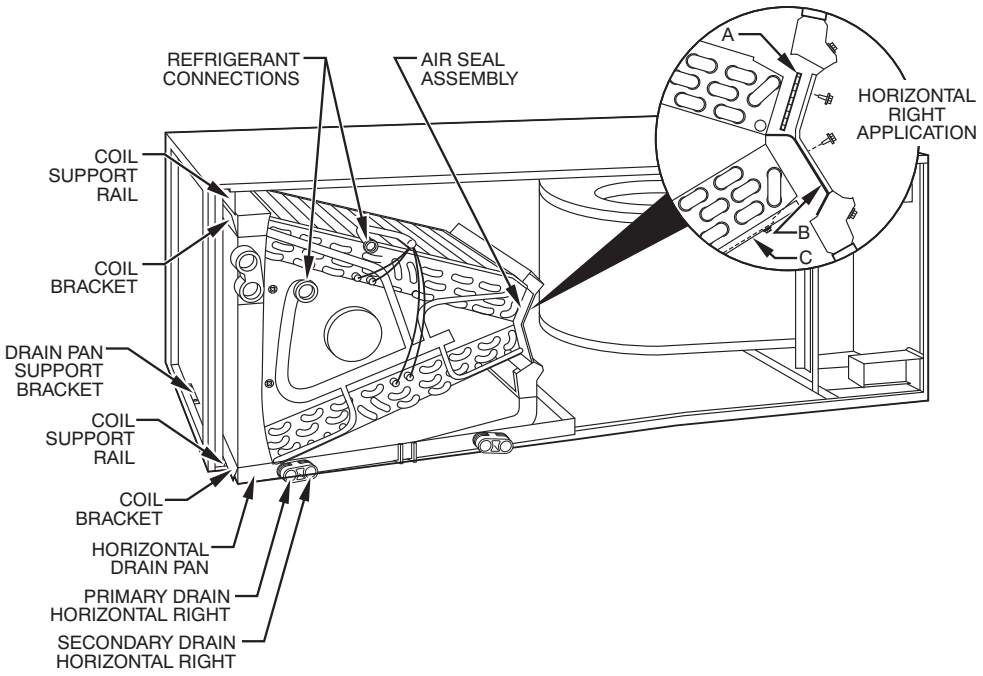


Fig. 6 - Slope Coil in Horizontal-Right Application



A00071

Fig. 7 - A-Coil in Horizontal-Right Application

E. Horizontal Right Conversion of Units With A-Coil

To convert units for horizontal right installations:

1. Remove blower and coil access panels. (See Fig. 6.)
2. Remove metal clip securing fitting panel to condensate pan. Remove fitting panel.
3. Remove 2 snap-in clips securing A-coil in unit.
4. Slide coil and pan assembly out of unit.
5. Remove horizontal drain pan support bracket from coil support rail on left side of unit and reinstall on coil support rail on right side of unit.
6. Convert air-seal assembly for horizontal right.
   a. Remove air-seal assembly from coil by removing 4 screws. (See Fig. 6.)
   b. Remove air splitter (B) from coil seal assembly by removing 3 screws. (See Fig. 6-factory-shipped inset.)
   c. Remove filler plate (A) and install air splitter (B) in place of filler plate.
   d. Install filler plate (A) as shown in horizontal right application.
   e. Remove condensate troughs (C) and install on opposite tube sheets.
   f. Install hose onto plastic spout.
7. Install horizontal pan on right side of coil assembly.
8. Slide coil assembly into casing. Be sure coil bracket on each corner of vertical pan engages coil support rails.
9. Reinstall 2 snap-in clips to correctly position and secure coil assembly in unit. Be sure clip with large offset is used on right side of unit to secure horizontal pan.
10. Remove two oval fitting caps from left side of the coil, access panel, and fitting panel.
11. Remove insulation knockouts on right side of coil access panel
12. Remove 2 oval coil access panel plugs and reinstall into holes on left side of coil access panel and fitting panel.
13. Install condensate pan fitting caps (from Step 10) in the right side of the coil door making sure that the cap snaps and seats cleanly on the back side of the coil door. Make sure no insulation interferes with seating of the cap.
14. Reinstall access and fitting panels, aligning holes with tubing connections and condensate pan connections. Be sure to reinstall metal clip between fitting panel and vertical condensate pan.

Make sure liquid and suction tube grommets are in place to prevent air leaks and cabinet sweating.

F. Downflow Installations

⚠ CAUTION

UNIT OR PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in product or property damage.

The conversion of the fan coil to downflow requires special procedures for the condensate drains on both A-coil and slope units. The vertical drains have an overflow hole between the primary and secondary drain holes. This hole is plugged for all applications except downflow, but must be used for downflow. During the conversion process, remove the plastic cap covering the vertical drains only and discard. Remove the plug from the overflow hole and discard. At completion of the downflow installation, caulk around the vertical pan fitting to door joint to retain the low air leak performance of the unit.

In this application, field conversion of the evaporator is required using accessory downflow kit along with an accessory base kit. Use fireproof resilient gasket, 1/8- to 1/4-in. (3.2 to 6.4mm) thick, between duct, unit, and floor.

NOTE: To convert units for downflow applications, refer to Installation Instructions supplied with kit for proper installation. For slope fan coils, use kit Part No. KFADC0201SLP. For A fan coils use kit Part No. KFADC0401ACL. Use fireproof resilient

gasket, 1/8- to 1/4-in. (3.2 to 6.4mm) thick, between duct, unit, and floor.

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in property damage.

Gasket kit number KFAHD0101SLP is required for horizontal slope coil conversion to maintain low air leak/low sweat performance.

G. Manufactured and Mobile Home Housing Applications

1. Fan coil unit must be secured to the structure using field-supplied hardware.
2. Allow a minimum of 24" (610 mm) clearance from access panels.
3. Recommended method of securing for typical applications
   a. If fan coil is away from wall, attach pipe strap to top of fan coil using No. 10 self tapping screws. Angle strap down and away from back of fan coil, remove all slack, and fasten to wall stud of structure using 5/16-in. (8mm) diameter lag screws. Typical both sides of fan coil.
   b. If fan coil is against wall, secure fan coil to wall stud using 1/8-in. (3mm) thick right-angle brackets. Attach brackets to fan coil using No. 10 self tapping screws and to wall stud using 5/16-in. (8mm) diameter lag screws. (See Fig. 7.)

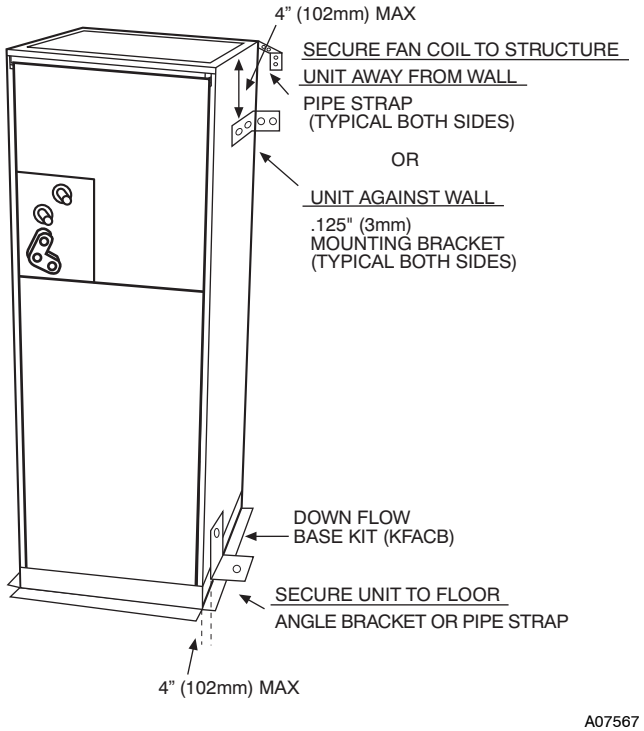


Fig. 8 - A-Coil

Procedure 3 — AIR DUCTS

Connect supply-air duct over outside of 3/4-in. (19mm) flange provided on supply-air opening. Secure duct to flange with proper fasteners for type of duct used, and seal duct-to-unit joint.

Duct connection flanges are provided on unit air discharge connection. When using FV4C units with 20-, 24-, and 30-kW electric heaters, maintain a 1-in. (25mm) clearance from combustible materials to discharge plenum and ductwork for a distance of 36 in. (914mm) from unit. Use accessory downflow base to maintain proper clearance on downflow installations.

Use flexible connectors between ductwork and unit to prevent transmission of vibration. When electric heater is installed, use heat resistant material for flexible connector between ductwork and unit at discharge connection. Ductwork passing through unconditioned space must be insulated and covered with vapor barrier.

Ductwork Acoustical Treatment

Metal duct systems that do not have a 90° elbow and 10 ft (3m) of main duct to first branch takeoff may require internal acoustical insulation lining.

As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with National Fire Protection Association Standards 90A or B as tested by UL Standard 181 for Class 1 air ducts.

Procedure 4 — ELECTRICAL CONNECTIONS

On units with a factory installed disconnect with pull-out removed, service and maintenance can be safely performed on only the load side of the control package.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Field wires on the line side of the disconnect found in the fan coil unit remain live, even when the pull-out is removed. Service and maintenance to incoming wiring cannot be performed until the main disconnect switch (remote to the unit) is turned off.

A. Line-Voltage Connections

If unit contains an electric heater, remove and discard power plug from fan coil and connect male plug from heater to female plug from unit wiring harness. (See Electric Heater Installation Instructions.)

For units without electric heat:

1. Connect 208/230v power leads from field disconnect to yellow and black stripped leads.
2. Connect ground wire to unit ground lug.

Check all factory wiring per unit wiring diagram and inspect factory wiring connections to be sure none were loosened in transit or installation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing or servicing system, always turn off main power to system. There may be more than one disconnect switch. Tag disconnect switch with a suitable warning label. Turn off accessory heater power if applicable.

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in product or property damage.

If a disconnect switch is to be mounted on unit, select a location where drill or fastener will not contact electrical or refrigerant components.

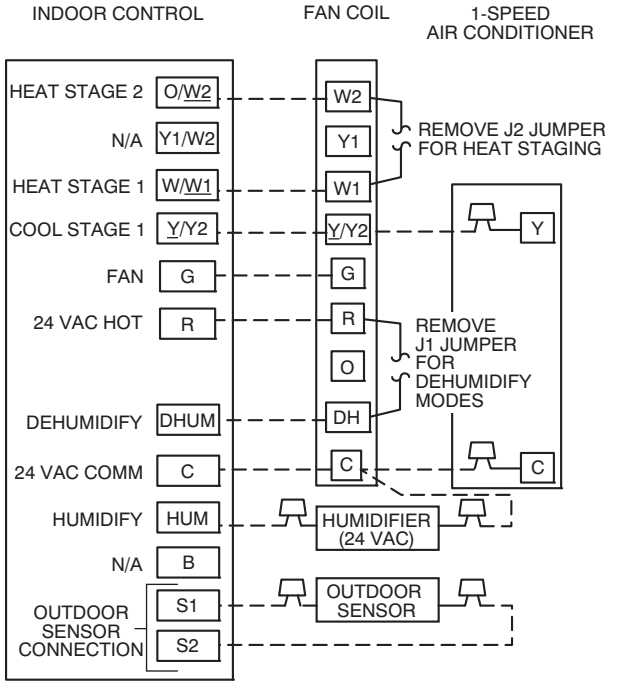
NOTE: Before proceeding with electrical connections, make certain that supply voltage, frequency, and phase are as specified on unit rating plate.

Be sure that electrical service provided by the utility is sufficient to handle the additional load imposed by this equipment. See unit wiring label for proper field high- and low-voltage wiring. Make all electrical connections in accordance with NEC and any local codes or ordinances that may apply. Use copper wire only. The unit must have a separate branch electric circuit with a field-supplied disconnect switch located within sight from, and readily accessible from the unit.

B. 24–V Control System Connections to Unit Printed-Circuit Board (PCB)

Refer to unit wiring instructions for recommended wiring procedures. Use No. 18 AWG color-coded, insulated (35°C minimum) wires to make low-voltage connections between thermostat and unit. If thermostat is located more than 100 ft (30m) from unit (as measured along the low-voltage wires), use No. 16 AWG color-coded, insulated (35°C minimum) wires. PCB is circuited for single-stage heater operation. When additional heater staging is desired using outdoor thermostats or Intelligent Heat Staging, remove Jumper J2 on PCB to enable staging.

Connect low-voltage leads to thermostat and outdoor unit. (See Fig. 9, 10, 11, or 12.)



A98477

Fig. 9 - FV4C Fan Coil Wiring with 1-Speed Air Conditioner

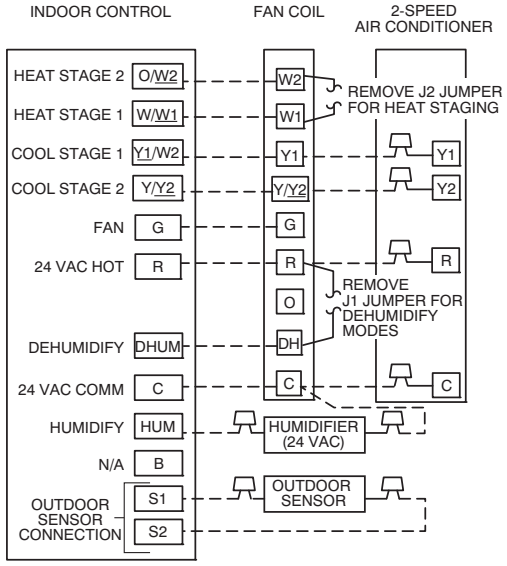


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Fig. 10 - FV4C Fan Coil Wiring with 2-Speed Air Conditioner

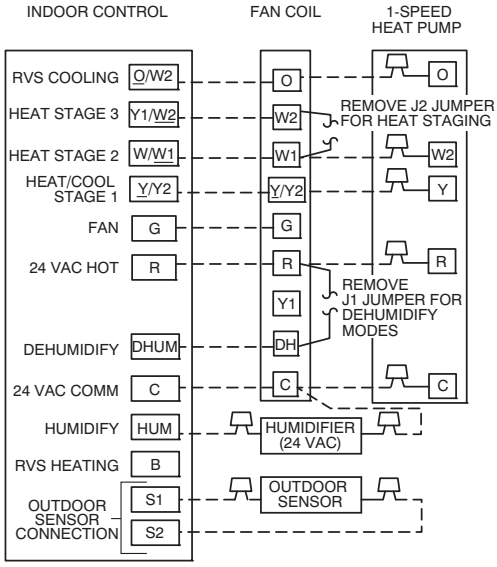

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Fig. 11 - FV4C Fan Coil Wiring with 1-Speed Heat Pump

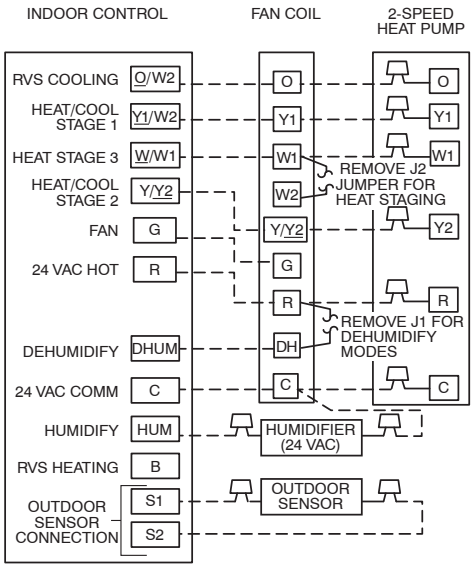


Fig. 12 - FV4C Fan Coil Wiring with 2-Speed Puron (R-410A) Refrigerant Heat Pump

C. Intelligent Heat Staging Option

Intelligent Heat staging of the electric heat package is possible when the FV4C is installed as a part of a single-speed heat pump system using a corporate 2-speed programmable thermostat , Thermidistat™ Control, or capable zoning control and any 1 of the following electric heat packages:

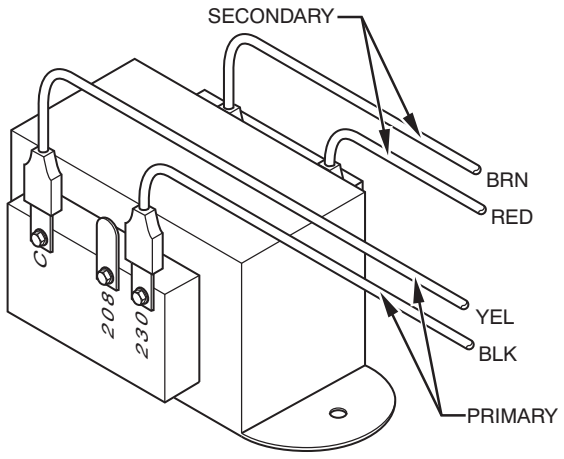
Relay heaters

KFCEH2901N09, KFCEH3001F15, KFCEH3101C15, KFCEH3201F20, KFCEH3301C20, KFCEH3401F24, or KFCEH3501F30.

Complete system low-voltage wiring as shown in Fig. 9, 10, 11, or 12.

NOTE: Where local codes require thermostat wiring be routed through conduit or raceways, splices can be made inside the fan coil unit. All wiring must be NEC Class l and must be separated from incoming power leads.

A factory-authorized disconnect kit is available for installation of 0- through 10-kW applications. When electric heat packages with circuit breakers are installed, the circuit breaker can be used as a disconnect. Transformer is factory wired for 230-v operation. For 208-v applications, disconnect black wire from 230-v terminal on transformer and connect it to 208-v terminal. (See Fig. 13.)



A05182

Fig. 13 - Transformer Connections

The secondary circuit of transformer is protected by a 5-amp fuse mounted on printed-circuit board.

IMPORTANT: Do not use outdoor thermostat with Intelligent Heat Staging.

D. Manufactured Housing

In manufactured housing applications, the Code of Federal Regulations, Title 24, Chapter XX, Part 3280.714 requires that supplemental electric heat be locked out at outdoor temperatures above 40°F (4°C) except for a heat pump defrost cycle. A corporate thermostat in conjunction with an outdoor sensor can be used to lock out supplemental heat above 40°F (4°C). Refer to thermostat instructions for details. If a non-corporate thermostat is used, an outdoor thermostat may be required.

E. Ground Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

According to NEC, NFPA 70, and local codes, the cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes. If conduit connection uses reducing washers, a separate ground wire must be used.

NOTE: Use UL listed conduit and conduit connector to connect supply wire(s) to unit and obtain proper grounding. Grounding may also be accomplished by using grounding lug provided in control box.

Use of dual or multiple supply circuits will require grounding of each circuit to ground lugs provided on unit and heaters.

Procedure 5 — REFRIGERANT TUBING CONNECTION AND EVACUATION

Use accessory tubing package or field-supplied tubing of refrigerant grade. Insulate entire suction tube if field-supplied tubing is used. Tubing package has an insulated suction tube. Do not use damaged, dirty, or contaminated tubing because it may plug refrigerant flow control device.

When tubing package is used and sweat connections are made within 60 sec, coil and tubing system does not require evacuation. Always evacuate coil and field-supplied tubing to 500 microns before opening outdoor unit service valves.

⚠ CAUTION

PRODUCT DAMAGE HAZARD

Failure to follow this caution may result in product or property damage.

A brazing shield MUST be used when tubing sets are being brazed to the unit connections to prevent damage to the unit surface and condensate pan fitting caps.

Units have sweat suction and liquid tube connections. Make suction tube connection first.

1. Cut tubing to correct length.
2. Insert tube into sweat connection on unit until it bottoms.
3. Braze connection using silver bearing or non-silver bearing brazing materials. Do not use solder (materials which melt below 800°F).

Consult local code requirements.

⚠ CAUTION

PRODUCT DAMAGE HAZARD

Failure to follow this caution may result in product or property damage.

Wrap a wet cloth around rear of fitting to prevent damage to TXV and factory-made joints**.**

4. Evacuate coil and tubing system to 500 microns using deep vacuum method.

Procedure 6 — CONDENSATE DRAIN

To connect drains the cap openings must be removed. Use a knife to start the opening near the tab and using pliers, pull the tab to remove the disk. Clean the edge of the opening if necessary and install the condensate line. Finally caulk around the lines where they exit the fitting to retain the low leak rating of the unit.

⚠ CAUTION

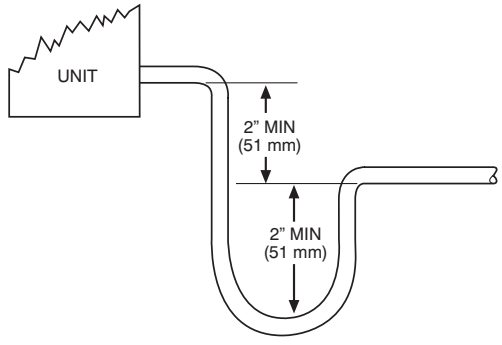
UNIT OR PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in product or property damage.

The conversion of the fan coil to downflow requires special procedures for the condensate drains on both A-coil and slope units. The vertical drains have an overflow hole between the primary and secondary drain holes. This hole is plugged for all applications except downflow, but must be used for downflow. During the conversion process, remove the plastic cap covering the vertical drains only and discard. Remove the plug from the overflow hole and discard. At completion of the downflow installation, caulk around the vertical pan fitting to door joint to retain the low air leak performance of the unit.

Units are equipped with primary and secondary 3/4-in. (19mm) FPT drain connections. For proper condensate line installation see Fig. 2, 4, 5, 6, and 8.

To prevent property damage and achieve optimum drainage performance, BOTH primary and secondary drain lines should be installed and include properly-sized condensate traps. (See Fig. 14 and 16.) Factory-approved condensate traps are available. Be sure to install plastic push-in plugs in unused condensate drain fittings. It is recommended that PVC fittings be used on the plastic condensate pan. Do not over-tighten. Finger-tighten plus 1-1/2 turns. Use pipe dope.



A03002

Fig. 14 - Recommended Condensate Trap

⚠ CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in product or property damage.

Shallow running traps are inadequate and DO NOT allow proper condensate drainage. (See Fig. 15.)

A03013

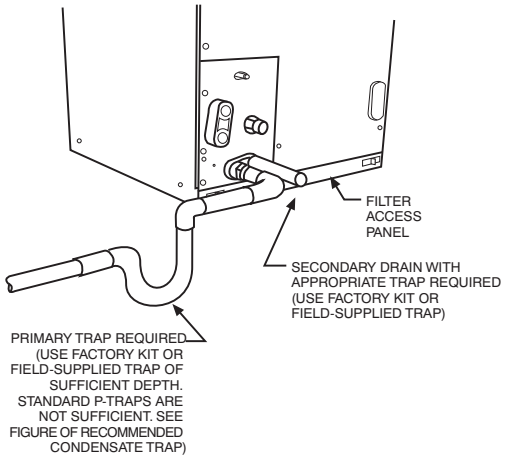
Fig. 15 - Insufficient Condensate Trap

NOTE: When connecting condensate drain lines avoid blocking filter access panel. Prime both primary and secondary condensate traps after connecting to drain pan.

NOTE: If unit is located in or above a living space where damage may result from condensate overflow, a field-supplied external condensate pan should be installed underneath the entire unit, and a secondary condensate line (with appropriate trap) should be run from the unit into the pan.

Any condensate in this external condensate pan should be drained to a noticeable place. As an alternative to using an external condensate pan, some localities may allow the use of a separate 3/4-in. (19mm) condensate line (with appropriate trap) to a place where the condensate will be noticeable. The owner of the structure must be informed that when condensate flows from the secondary drain or external condensate pan, the unit requires servicing, or water damage will occur.

Install traps in the condensate lines as close to the coil as possible. (See Fig. 16.) Make sure that the outlet of each trap is below its connection to the condensate pan to prevent condensate from overflowing the drain pan. Prime all traps, test for leaks, and insulate traps if located above a living area.



A03003

Fig. 16 - Insufficient Condensate Trap

Condensate drain lines should be pitched downward at a minimum of 1 in. (25mm) for every 10 ft. (3m) of length. Consult local codes for additional restrictions or precautions.

⚠ CAUTION

UNIT COMPONENT HAZARD

Failure to follow this caution may result in product damage.

Never operate unit without a filter. Damage to blower motor or coil may result. Factory authorized filter kits must be used when locating the filter inside the unit. For those applications where access to an internal filter is impractical, a field-supplied filter must be installed in the return duct system.

IMPORTANT: Factory authorized filters must be used when locating the filter inside the unit. (See Table 1.)

Table 1 – Filter Kits

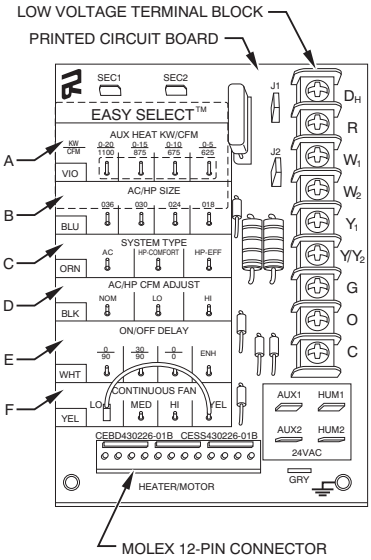
	PART NUMBER	SIZE USED WITH
FILTER KIT (12 PACK)	KFAFK0212MED	002
	KFAFK0312LRG	003, 005
	KFAFK0412XXL	006

Procedure 7 — UNIT START-UP

Refer to outdoor unit Installation Instructions for system start-up instructions and refrigerant charging method details.

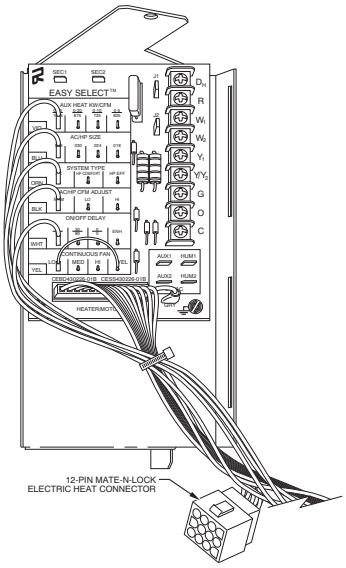
Procedure 8 — EASY SELECT CONFIGURATION TAPS

Easy Select™ taps are used by the installer to configure a system. The ECM motor uses the selected taps to modify its operation to a pre-programmed table of airflows. (See Table 3 and 4.) Airflows are based on system size or mode of operation and those airflows are modified in response to other inputs such as the need for de-humidification. (See Fig. 17 and 18.)



A95275

Fig. 17 - Detail of FV4C Printed-Circuit Board



A95276

Fig. 18 - Detail of FV4C Printed-Circuit Board

The FV4C Fan Coil must be configured to operate properly with system components with which it is installed. To successfully configure a basic system (see information printed on circuit board label located next to select pins), move the 6 select wires to the pins which match the components used.

A. AUX HEAT KW/CFM - Select heater range for size of electric heater installed

Installer must select the auxiliary heat airflow approved for application with kW size heater installed. If no heater is installed, this step can be skipped. Each select pin is marked with a range of heaters for which airflow, also marked, is approved. For increased comfort select the narrowest kW range matching the heater size, for example, 0-10 for 10-kW heater. This airflow must be greater than the minimum CFM for electric heater application with the size system installed for safe and continuous operation. (See Table 5 and 6 for airflow delivery and minimum CFM.) Note that airflow marked is the airflow which will be supplied in emergency heat mode and heating mode on air conditioners when electric heat is the primary heating source. In heat pump heating mode when electric heaters are energized, the ECM motor will run the higher of heat pump heating airflow and electric heater airflow to ensure safe

heater operation. The factory selection is the largest heater range approved. (See Fig. 17, A as indicated.)

B. AC/HP SIZE - Select system size installed

The factory setting for air conditioner or heat pump size is the largest unit meant for application with the model of fan coil purchased. Installer needs to select air conditioner or heat pump size to ensure that airflow delivered falls within proper range for the size unit installed. This applies to all operational modes with the exception of electric heat modes. (See Fig. 17, B as indicated.)

C. SYSTEM TYPE - Select system type installed AC or HP

The type of system must be selected:

1. AC - Air conditioner
2. HP-COMFORT - Heat Pump Comfort provides approximately 315 CFM per ton for higher normal heating air delivery temperature. Provides approximately 350 CFM per ton cooling airflow for good humidity removal.
3. HP-EFF - Heat Pump Efficiency provides same airflow for heating and cooling modes to increase overall HP efficiency; approximately 350 CFM per ton. The factory setting is AC. (See Fig. 17, C as indicated.)

D. AC/HP CFM ADJUST - Select Medium, Low, or High Airflow

To provide airflow at rates described above, the AC/HP ADJUST select is factory set to the nominal (nom) tap. The adjust selections HI/LO will regulate airflow supplied for all operational modes, except non-heat pump heating modes. HI provides 15% airflow over nominal unit size selected and LO provides 10% airflow below nominal unit size selected. Adjust selection options are provided to adjust airflow supplied to meet individual installation needs for such things as noise, comfort, and humidity removal. (See Fig. 17, D as indicated.)

E. ON/OFF DELAY - Select desired time delay profile

NOTE: Delay selections are active in cooling and heat pump heating modes only. Auxiliary heating modes have a 1 minute off delay and zero on delay programmed into the ECM motor that cannot be overridden.

Four motor operation delay profiles are provided to customize and enhance system operation. (See Fig. 17, E as indicated)
Selection options are:

1. The standard 90 sec off delay (Factory setting) at 100% airflow.
2. No delay option used for servicing unit or when a thermostat is utilized to perform delay functions.
3. A 30 sec on delay with no airflow/90 sec off delay at 100% airflow profile is used when it is desirable to allow system coils time to heat-up/cool-down in conjunction with the airflow.
4. ENH, enhanced selection, provides a 30 sec on delay with no airflow/ plus 150 sec at 70% airflow/ no off delay for added comfort. This profile will minimize cold blow in heat pump operation and could enhance system efficiency.

F. CONTINUOUS FAN - Select desired fan speed when thermostat is set on continuous fan

NOTE: If installed with a 2-speed outdoor unit, do not select HI speed continuous fan. If HI is selected, low speed compression will also run HI speed possibly resulting in insufficient dehumidification.

1. LO speed - factory setting, 50% cooling mode airflow.
2. MED speed - move connector to MED, 80% cooling mode airflow.
3. HI speed - move connector of HI, 100% cooling mode airflow. (See Fig. 17, F as indicated.)

G. Low-Voltage Circuit Fusing and Reference

The low-voltage circuit is fused by a board-mounted 5-amp automotive fuse placed in series with the transformer SEC2 and the R circuit. The C circuit of the transformer is referenced to chassis ground through a printed circuit run at SEC1 connected to metal standoff marked with ground symbol.

H. Basic Fan Coil Configuration

The following basic configuration of the fan coil will provide ARI rated performance of the heat pump:

1. AUX HEAT KW/CFM - Select the heater range for the size electric heater installed.
2. AC/HP SIZE - Select system size installed.
3. SYSTEM TYPE - Select system type HP-EFF.
4. AC/HP CFM ADJUST - Select NOM.
5. ON/OFF DELAY - Select 0/90 profile.
6. CONTINUOUS FAN - Select desired fan speed when thermostat is set to continuous fan.

I. COMFORT OPTIONS - WARMER HEATING AND SUPER DEHUMIDIFY (See Fig. 21 for Quick Reference Guide)

The FV4C Fan Coil provides better than average humidity control and heated air temperature. This configuration will improve the comfort provided by the heat pump system if more humidity removal or if warmer heating air is desired. While providing this improved comfort, the heat pump system will operate efficiently, but not at the published HSPF or ARI SEER efficiency.

The following fan coil configuration is recommended for maximum heating and cooling/dehumidifying comfort: (See Fig. 17.)

1. AUX HEAT KW/CFM - Select narrowest heater range to match size of electric heater installed (skip this step if no heater is installed).
2. AC/HP SIZE - Select system size installed.
3. SYSTEM TYPE - Select system type HP-COMFORT (for heat pump system) or AC (for air conditioner system).
4. AC/HP CFM ADJUST - Select LO.
5. ON/OFF DELAY - Select ENH profile.
6. CONTINUOUS FAN - Select desired fan speed when thermostat is set to continuous fan.
7. If the fan coil is installed with Intelligent Heat Staging capable electric heaters, remove jumper J2. (See Fig. 17.)

NOTE: If configuring to run warmer heating, do not remove jumper J2 when using 5-, 8-, or 10-kW heaters.

8. Remove jumper J1 to activate dehumidify modes.
9. Wire low voltage connections as shown in Fig. 9, 10, 11, or 12.
10. Configure Thermidistat (or capable zoning system) following its installation instructions for enhanced dehumidification and SuperComfort/Perfect Heat operation.

This configuration provides the following comfort enhancements:

a. A 30 second blower on delay with 150 seconds at 70% airflow to allow the indoor coil to warm up or cool down before the blower is asked to deliver 100% airflow reducing the cold blow sensation at start up in heating and allowing the indoor coil to more quickly reach wet coil operating conditions in cooling.

b. No blower off delay eliminates cold blow which may be associated with running the blower after shut down of the compressor and avoids re-evaporation of condensed moisture after cooling/dehumidifying operation.

c. Lower airflow while the compressor is running to reduce draft effects and increase heating air temperature and improved humidity control during cooling operation.

d. Intelligent Staging of the electric heater elements to more closely match heating load requirements and provide more consistent heating air temperatures.

Procedure 9 — ACCESSORY INSTALLATION

A. Accessory Electric Heaters

Electric heaters may be installed with the FV4C Fan Coil per instructions supplied with electric heater package. See unit rating plate for factory-approved electric heater kits.

NOTE: Units installed without electric heat should have a sheet metal block-off plate covering the heater opening. This reduces air leakage and formation of exterior condensation.

B. Auxiliary Terminals

The AUX and HUM terminals on the Easy Select Board are tied directly to the G terminal, and provide a 24-vac signal whenever the G terminal is energized. (See Fig. 17 and 18.) During Super Dehumidify and SuperComfort / Perfect Heat modes, the G signal is not present and the auxiliary terminals are not energized. If the installation includes the use of these operating modes, do not use these terminals to control accessories. See Electronic Air Cleaner and Humidifier sections for further information.

C. Electronic Air Cleaner Connections

The AUX1 and AUX2 terminals are not always energized during blower operation, as described above. When using an electronic air cleaner with the FV4C Fan Coil, use Airflow Sensor Part No. KEAAC0101AAA. The airflow sensor turns on electronic air cleaner when the fan coil blower is operating.

D. Humidifier/Humidistat Connections

Easy Select Board terminals HUM1 and HUM2 are provided for direct connection to the low-voltage control of a humidifier through a standard humidistat. (See Fig. 19.) These terminals are energized with 24vac when G thermostat signal is present. (See Fig. 20.) Alternately, the 24-vac signal may be sourced from the W and C terminal block connections when electric heaters are used as primary heating source. When using a Thermidistat™ Control, Zone Perfect Plus or Comfort Zone II, the 24-vac signal may be sourced directly from the Thermidistat HUM terminal. (See Fig. 9, 10, 11, and 12.)

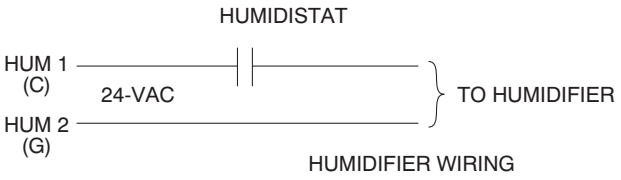


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Fig. 19 - Humidifier Wiring

E. Dehumidify Capability with Standard Humidistat Connection

Latent capacities for systems using the FV4C Fan Coil are better than average systems. If increased latent capacity is an application requirement, the field wiring terminal block provides connection terminals for use of a standard humidistat. The FV4C Fan Coil will detect the humidistat contacts opening on increasing humidity and reduce its airflow to approximately 80% of nominal cooling mode airflow. This reduction will increase the system latent capacity until the humidity falls to a level which causes the humidistat to close its contacts. When the contacts close, the airflow will return to 100% of the selected cooling airflow. To activate this mode, remove Jumper J1 and wire in a standard humidistat. (See Fig. 20.)

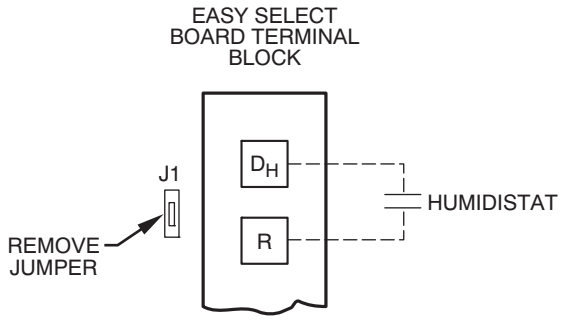

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Fig. 20 - Humidistat Wiring for De-Humidify Mode

F. Dehumidify and Super Dehumidify Capabilities

This model fan coil is capable of responding to a signal from indoor system control (Thermidistat, zoning control) to operate in comfort control modes such as Super Dehumidify Mode. Consult literature provided with indoor system control to determine if these operating modes are available, and to see control set up instructions. No special setup or wiring of fan coil is required.

Procedure 10 — FV4C FAN COIL SEQUENCE OF OPERATION

The FV4C will supply airflow in a range which is more than twice the range of a standard fan coil. It is designed to provide nominal cooling capacities at a 50°F (10°C) evaporator temperature and the required airflow which enables it to match with 4 air conditioner or heat pump system sizes. Table 2 outlines the CFM range for the different FV4C Fan Coil sizes.

A. Continuous Fan

- Thermostat closes circuit R to G.
- The blower runs at continuous fan airflow.

B. Cooling Mode - Single speed

- If indoor temperature is above temperature set point and humidity is below humidity set point, thermostat closes circuits R to G, R to Y/Y2 and R to O.
- The fan coil delivers single speed cooling airflow.

C. Cooling Mode - Dehumidification

- If indoor temperature is above temperature set point and humidity is above humidity set point, thermostat or Thermidistat™ closes circuits R to G, R to O, and R to Y/Y2, and humidistat or Thermidistat opens R to DH.
- The fan coil delivers airflow which is approximately 80% of the nominal cooling airflow to increase the latent capacity of the system.

D. Cooling Mode - Super Dehumidify Operation (See Fig. 22 for Quick Reference Guide)

NOTE: The indoor control used, such as Thermidistat, must be capable of providing Super Dehumidify operation mode and control must be configured as outlined in its installation instructions. Consult indoor control literature to determine if control is capable of providing Super Dehumidify inputs and for configuration instructions.

If the indoor temperature is below the temperature set point and the humidity is above the humidity set point, the Thermidistat closes circuit R to O, opens circuits R to DH and R to G, and cycles circuit R to Y/Y2 (for single speed system R to Y1, or R to Y1 and Y/Y2 for 2-speed system).

The ECM motor reads the G signal to the fan coil while the heat pump is operating, (circuit R to Y/Y2 for single speed system, R to Y1 or R to Y1 and Y/Y2 for 2-speed system), closed (24 vac). If circuit R to G is closed (24 vac), the motor will deliver airflow at

the full cooling or cooling plus dehumidify mode requested value. If circuit R to G is open (0 vac) for super dehumidify mode, the motor delivers reduced airflow to maximize the humidity removal of the system while minimizing over-cooling.

E. Electric Heat Heating Mode

- Thermostat closes circuit R to W/W1, or W2.
- The fan coil delivers the selected electric heat airflow.

F. Heat Pump Heating Mode - Single speed

- Thermostat closes circuits R to G and R to Y/Y2.
- The fan coil delivers single speed heat pump heating airflow.

G. Heat Pump Heating with Auxiliary Electric Heat

Thermostat closes circuits R to G, R to Y/Y2 and/or R to Y1 with R to W/W1 or W2 (and R to O in the case of defrost).

In the event that electric heating is called for by the thermostat while the heat pump is also operating in either heating or defrost modes, the motor will modify its airflow output, if necessary, to provide an airflow which is defined as safe for the operation of the electric heater during heat pump operation. That airflow is the greater of the heat pump heating airflow and the electric heater only airflow.

Procedure 11 — TROUBLESHOOTING ECM MOTOR AND CONTROLS

⚠ CAUTION

ELECTRICAL SHOCK HAZARD

Failure to follow this caution may result in personal injury.

High voltage is always present at motor. Disconnect power to unit before removing or replacing connectors or servicing motor. Wait at least 5 min after disconnecting power before opening motor.

The ECM motor used with this product contains two parts: the control module and motor winding section. Do not assume the motor or module is defective if it will not start. Go through the steps described below before replacing control module, Easy Select Board or entire motor. The control module is available as a replacement part.

A. If motor turns slowly:

1. Replace panel. Motor may appear to run slowly if access panel is removed.
2. It is normal operation to run noticeably slower if G terminal is not energized in cooling or heat-pump modes.

B. If motor does not run:

Turn off power and check the following:

1. Check 5 amp fuse on Easy Select Board.
2. Check for 24vac on SEC1 and SEC2. If no voltage is present, check transformer.
3. Check all plugs and receptacles for any deformation which could cause loose connections. Be sure plugs are fully seated.
4. Verify that approximately 230vac is present at motor.
5. Verify low-voltage control signals to motor. The motor receives its control signals through the 12-pin plug (PL-1) on Easy Select Board and 16-pin plug on wiring harness. (See Troubleshooting Example.) The combinations of pins energized will determine motor speed. (See Fig. 20.) See Table 7 for circuit board, low-voltage screw terminals energized and for voltage present at each pin on 12-pin plug (PL-1). See Table 7 for pin number on 16-pin plug which should have voltage when Easy Select Board screw terminals have 24vac.

C. Use following procedure to check control signals:

THERMOSTAT

1. Remove all thermostat wires from Easy Select Board.
2. Jumper screw terminals (1 at a time): R-G, R-Y/Y2, R-Y1, R-W1. If motor runs in all cases, thermostat is mis-wired, configured incorrectly or defective. If motor runs in some cases, but not others, continue to check wiring harness and circuit board.

WIRING HARNESS

1. Shut off power to unit; wait 5 min.
2. Remove 5-pin plug from motor.
3. Remove 16-pin from motor.
4. Replace 5-pin plug and turn power on.
5. Check for appropriate voltages on 16-pin connector with screw terminals jumpered. (See Table 7 for values and see examples below.)

If signals check correctly and motor does not run, inspect wiring harness for loose pins or damaged plastic that could cause poor connections. If connections are good, either control module or motor is defective. If proper signals are not present, check circuit board using procedure below:

12-PIN PLUG (PL-1) ON EASY SELECT BOARD

1. Unplug harness from board.
2. Check for appropriate voltages on pins with Easy Select Board screw terminals jumpered. (See Table 7 for values and see example below.)

If proper signals are not present, replace Easy Select Board. If present at board and not at 16-pin connector, wiring harness is defective.

TROUBLESHOOTING EXAMPLE:

Motor is not running on a call for heat-pump heating. System is a single-speed heat pump.

1. After performing checks in Thermostat section, follow steps 1 thru 5 in Wiring Harness section. Then proceed with example.
2. With all thermostat wires removed from Easy Select Board, place a jumper wire between R and Y/Y2 low-voltage screw terminals on the Easy Select board.
3. Check Table 7 for pin number on 16-pin connector associated with the Y/Y2 signal. The correct pin is #14. The far right column shows that (-) 12vdc should be present between pin #14 and pin #1 (common) on the 16-pin connector.
4. Set meter to read DC voltage. Place meter between pins #1 and #14 and check for (-) 12vdc (common side of meter on pin #1). If signal is present, the problem is in the module or motor. If signal is not, problem is either in wiring harness or Easy Select Board.

These steps can be repeated for other modes of operation.

To check Easy Select Board:

1. Leave jumper wire in place between R and Y/Y2.
2. Check Table 7 under "Wiring Harness Connection to Easy Select Board" column and row for pin #14 to see pin# on Easy Select Board that should have voltage. The correct pin is #2. The column on far right will show voltage that should be present between pin #2 and #9 (or #10 common).
3. Place meter between pins #2 and #9 on Easy Select Board and check for (-) 12vdc.
4. If voltage is present, the wiring harness is bad; if not, the Easy Select Board is bad.

D. Verify Motor Winding Section:

Before proceeding with module replacement, check the following to ensure motor winding section is functional. With control module removed and unplugged from winding section:

1. The resistance between any 2 motor leads should be similar.
2. The resistance between any motor lead and the unpainted motor end plate should be greater than 100K ohms.

If motor winding section fails one of these tests, it is defective and must be replaced.

START-UP PROCEDURES

Refer to outdoor unit Installation Instructions for system start-up instructions and refrigerant charging method details.

CARE AND MAINTENANCE

For continuing high performance, and to minimize possible equipment failure, it is essential that periodic maintenance be performed on this equipment. The only required maintenance that may be performed by the consumer is filter maintenance.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect all power to unit before servicing field wires or removing control package. The disconnect (when used) on access panel does not disconnect power to the line side of disconnect, but does allow safe service to all other parts of unit. If unit does not have a disconnect, disregard the foregoing. Instead, make sure that a disconnecting means is within sight from, and is readily accessible from, the unit. Disconnect all electrical power to unit before performing any maintenance or service on it.

The minimum maintenance requirements for this equipment are as follows:

1. Inspect and clean or replace air filter each month or as required.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean as necessary. An inspection port is provided on all A-coil delta plates. Remove plastic plug to inspect.
3. Inspect blower motor and wheel for cleanliness each heating and cooling season. Clean as necessary.
4. Inspect electrical connections for tightness and controls for proper operation each heating and cooling season. Service as necessary.

Consult Fan Coil Service Manual available from equipment distributor for maintenance procedures.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

Using the Owner's/User Manual furnished in outdoor unit, the installing technician should explain system operation to the consumer with particular emphasis on indoor fan coil operation sounds and filter maintenance.

Table 2 – CFM Range for FV4C Units

FAN COIL SIZE	SYSTEM SIZES	CFM RANGE
FV4CNF002	024, 030, 036	350-1275
FV4CN(B,F)003	024, 030, 036, 042	415-1475
FV4CN(B,F)005	036, 042, 048	425-1700
FV4CNB006	042, 048, 060	540-2150

Table 3 – FV4C Fan Coil Airflow Delivery (CFM) in Cooling Mode

OPERATING MODE											
UNIT SIZE	OUTDOOR UNIT CAPACITY	SINGLE—SPEED APPLICATION		TWO—SPEED APPLICATION				FAN ONLY		
				High Speed		Low Speed				
		Nominal A/C Cooling	A/C Cooling Dehumidity	Nominal A/C Cooling	A/C Cooling Dehumidity	Nominal A/C Cooling	A/C Cooling Dehumidity	Lo	Med	High
002	018	525	420	—	—	—	—	350	420	525
	024	700	560	700	560	560	450	350	560	700
	030	875	700	—	—	—	—	440	700	875
	036	1050	840	1050	840	840	670	525	840	1050
003	024	700	560	700	560	560	450	415	560	700
	030	875	700	—	—	—	—	440	700	875
	036	1050	840	1050	840	840	670	525	840	1050
	042	1225	980	—	—	—	—	610	980	1225
005	030	875	700	—	—	—	—	440	700	875
	036	1050	840	1050	840	840	670	525	840	1050
	042	1225	980	—	—	—	—	610	980	1225
	048	1400	1120	1400	1120	1120	895	700	1120	1400
006	036	1050	840	1050	840	840	670	540	840	1050
	042	1225	980	—	—	—	—	610	980	1225
	048	1400	1120	1400	1120	1120	895	700	1120	1400
	060	1750	1400	1750	1400	1400	1120	875	1400	1750

NOTES:

1. The above airflows result with the AC, HP CFM ADJUST select jumper set on NOM.
2. Air flow can be adjusted +15% or −10% by selecting HI or LO respectively for all modes except fan only.
3. Dry coil at 230 volts and with 10KW heater and filter installed.
4. Airflows shown are at standard air conditions.

Table 4 – FV4C Fan Coil Airflow Delivery (CFM) in Heat Pump Only Heating Mode

OPERATING MODE										
UNIT SIZE	OUTDOOR UNIT CAPACITY	SINGLE—SPEED APPLICATION		TWO—SPEED APPLICATION				FAN ONLY		
				High Speed		Low Speed				
		Heat Pump Comfort	Heat Pump Efficiency	Heat Pump Comfort	Heat Pump Efficiency	Heat Pump Comfort	Heat Pump Efficiency	Lo	Med	High
002	018	470	525	—	—	—	—	350	380	470
	024	630	700	630	700	505	560	350	505	630
	030	785	875	—	—	—	—	390	630	785
	036	945	1050	945	1050	755	840	470	755	945
003	024	630	700	630	700	415	560	415	505	630
	030	785	875	—	—	—	—	415	630	785
	036	945	1050	945	1050	755	840	470	755	945
	042	1100	1225	—	—	—	—	550	880	1100
005	030	785	875	—	—	—	—	425	630	785
	036	945	1050	945	1050	755	840	470	755	945
	042	1100	1225	—	—	—	—	550	880	1100
	048	1260	1400	1260	1400	1010	1120	630	1010	1260
006	036	945	1050	945	1050	755	840	540	755	945
	042	1100	1225	—	—	—	—	550	880	1100
	048	1260	1400	1260	1400	1010	1120	630	1010	1260
	060	1575	1750	1575	1750	1260	1400	785	1260	1575

NOTES:

1. The above airflows result with the AC, HP CFM ADJUST select jumper set on NOM.
2. Air flow can be adjusted +15% or −10% by selecting HI or LO respectively for all modes except fan only.
3. Dry coil at 230 volts and with 10KW heater and filter installed.
4. Airflows shown are at standard air conditions.

Table 5 – FV4C Airflow Delivery (CFM)

FAN UNIT SIZE	OUTDOOR UNIT CAPACITY BTUH	ELECTRIC HEATER kW RANGE											
		0–5			0–10			0–15			0–20		
		Lo	Nom	High	Lo	Nom	High	Lo	Nom	High	Lo	Nom	High
002	18,000	625	625	625	675	675	–	–	–	–	–	–	–
	24,000	650	725	835	–	725	835	875	875	875	–	–	–
	30,000	815	905	1040	–	905	1040	900	900	1040	1100	1100	1100
	36,000	980	1085	1250	980	1085	1250	980	1085	1250	1100	1100	1250
003	24,000	675	725	835	875	875	–	–	–	–	–	–	–
	30,000	815	905	1040	875	905	1040	1100	1100	1100	–	–	–
	36,000	980	1085	1250	980	1085	1250	1100	1100	1250	1225	1225	1250
	42,000	1140	1270	1460	1140	1270	1460	1140	1270	1460	1225	1270	1460
FAN UNIT SIZE	**OUTDOOR UNIT CAPACITY BTUH**	**ELECTRIC HEATER kW RANGE**											
		0–10			**0–15**			**0–20**			**0–30**		
		Lo	**Nom**	**High**	**Lo**	**Nom**	**High**	**Lo**	**Nom**	**High**	**Lo**	**Nom**	**High**
005	30,000	975	975	1040	1100	1100	1100	–	–	–	–	–	–
	36,000	980	1085	1250	1100	1100	1250	1250	1250	1250	–	–	–
	42,000	1140	1270	1460	1140	1270	1460	1250	1270	1460	–	–	–
	48,000	1305	1450	1665	1305	1450	1665	1305	1450	1665	1500	1500	1665
006	36,000	1100	1100	1250	1350	1350	1350	–	–	–	–	–	–
	42,000	1140	1270	1460	1350	1350	1460	1525	1525	1525	–	–	–
	48,000	1305	1450	1665	1350	1450	1665	1525	1525	1665	1750	1750	1750
	60,000	1630	1810	2085	1630	1810	2085	1630	1810	2085	1750	1810	2085

NOTE: Lo, NOM, and HI refer to AC, HP CFM ADJUST selection.
– Airflow not recommended for heater/system size.

Table 6 – FV4C Minimum CFM for Electric Heater Application

FAN COIL UNIT	HEAT PUMP UNIT SIZE	CFM				
		HEATER SIZE kW				
		5	8, 9, 10	15	18, 20	24, 30
002	Heater Only	625	625	725	875	—
	018	625	625	—	—	—
	024	650	725	875	—	—
	030	800	875	875	1040	—
	036	970	970	970	1040	—
003	Heater Only	675	700	1050	1050	—
	024	675	875	—	—	—
	030	800	875	1100	—	—
	036	975	975	1100	1225	—
	042	1125	1125	1125	1225	—
005	Heater Only	675	700	1050	1050	1400
	018	800	875	1100	—	—
	036	975	975	1100	1225	—
	042	1125	1125	1125	1225	—
	048	1305	1305	1305	1305	1400
006	Heater Only	1050	1050	1050	1050	1750
	018	1100	1100	1350	1350	—
	042	1125	1125	1350	1350	—
	048	1300	1300	1350	1465	1750
	060	1625	1625	1625	1750	1750

NOTES:
1. Heater Only–Air conditioner with electric heater application.
2. These airflows are minimum acceptable airflows as UL listed. Actual airflow delivered will be per airflow deliver chart for Electric Heating Modes.

Table 7 – Wiring connection of FV Fan Coil Wiring Harness

16–IN PLUG ON WIRING HARNESS TO MOTOR			WIRING HARNESS CONNECTION TO EASY SELECT BOARD		
Pin on 16–Pin Plug	**Description**		**Pin on 12–Pin Plug or Set–up Selection**	**Wire Color**	**Signal on Pin with Screw Terminal Jumpered to R***
1	Common		Pin 9 on PL–1	Brown	
2	W1		Pin 7 on PL–1	Violet	24VAC**
3	Common	Auxiliary Heat Stage 1	Pin 10 on PL–1	Orange	
4	On/Off Delay Selection		On/Off Delay Selection	White	
5	AC/HP Size Selection		AC/HP Size Selection	Blue	
6	Y1	Low Speed AC or HP	Pin 3 on PL–1	Black	(–) 12VDC**
7	AC/HP CFM Adjust Selection		AC/HP CFM Adjust Selection	Black	
8	Not Used		N/A	Not Used	
9	System Type Selection		System Type Selection	Orange	
10	Dehumidify		Pin 12 on PL–1	Gray	0V (24VAC on no call)
11	Aux Heat Size Selection		Aux Heat Size Selection	Violet	
12	24v AC		Pin 8 on PL–1	Red	24VAC continuous
13	W2	Auxiliary Heat Stage 2	Pin 4 on PL–1	White	24VAC**
14	Y/Y2	Single Speed AC or HP, High Speed 2–Speed AC or HP	Pin 2 on PL–1	Yellow	(–) 12VDC*
15	G	Fan	Pin 1 on PL–1	Green	24VAC**
16	Not Used		N/A	Not Used	

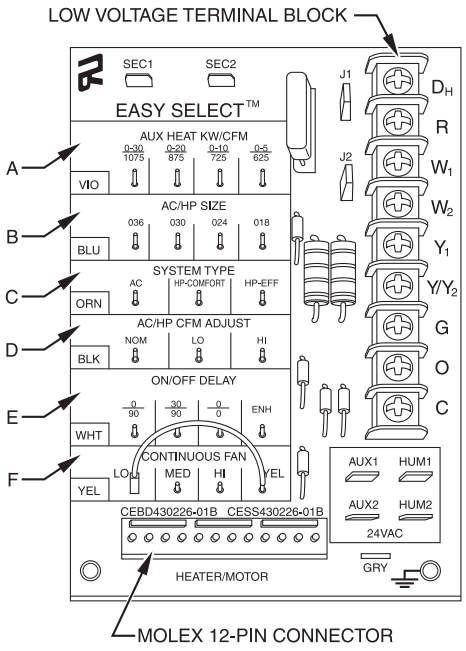
* Check voltages with 16–Pin Plug disconnected from motor.
** These signals will start motor.

PURON® (R-410A) QUICK REFERENCE GUIDE

- Puron refrigerant operates at 50-70 percent higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with Puron
- Puron refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- Puron systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low-side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- Puron, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid-line filter driers with rated working pressures less than 600 psig.
- Do not leave Puron suction line filter driers in line longer than 72 hours.
- Do not install a suction-line filter drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory approved liquid-line filter drier is required on every unit.
- Do NOT use an R-22 TXV.
- If indoor unit is equipped with an R-22 TXV or piston metering device, it must be changed to a hard shutoff Puron TXV.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent Puron into the atmosphere.
- Do not use capillary tube coils.
- Observe all **warnings**, **cautions**, and **bold** text.
- All indoor coils must be installed with a hard shutoff Puron TXV metering device.

QUICK REFERENCE GUIDE

SET-UP INSTRUCTIONS FOR WARMER HEATING TEMPERATURES AND SUPER HUMIDITY CONTROL IN COOLING



EASY SELECT BOARD

1. Configuration Taps
   (See Installation Instructions, for detailed description.)
   A. AUX HEAT - Set for heater size (Ex: 0-10 for 10 kw)
   B. AC/HP SIZE - Set for size of outdoor unit
   C. SYSTEM TYPE - Select "HP COMFORT"
   D. AC/HP CFM ADJUST - Select "LO"
   E. ON/OFF DELAY - Select "ENH"
   F. CONTINUOUS FAN - Select desired speed
2. Install heater with Intelligent Heat Staging, and remove Jumper J2, except when using 5-, 8-, or 10-kw heater.
3. Remove Jumper J1 to activate all dehumidify modes.
4. Complete wiring and install outdoor temperature sensor according to Installation Instructions.

THERMIDISTAT™ CONTROL SETTINGS

1. Set "DIP Switches" - Set the dip switches (back of Thermidistat Control Board) appropriately for specific system being installed.
2. Thermidistat Control Configurations
   (See Thermidistat™ Control Installation Instructions for detailed description.)
   - Option 5 (Variable Speed Motors) - set to ON
   - Option 7 (Super Dehumidify) - set to ON
   - Option 9 (Intelligent Heat) - set to ON if installing with a single speed heat pump
   - Option 12 (Heaters during Defrost) - setting "2" is suggested for all heaters
   - Option 16 - Set to ON for warmer heat below 40° F.
   - Option 17 - Select programmable or non-programmable mode.
3. Set desired humidity level on front of Thermidistat (50 to 55% RH recommended). For cool to dehumidify operation, both "dhu" and "cool" must be displayed.

Printed in U.S.A. Edition Date: 05/09 **Catalog No: IM–FV4C–01**

Replaces: NEW

Bardi
24/7 Heating & Air Conditioning
The Climate's Always Right With Bardi

Section #3

Heat Pump Condensing Unit Warranty

Carrier

CARRIER CORPORATION

Limited Warranty for Air Conditioner & Heat Pump Condensing Units with Puron® (R-410A) Refrigerant

FOR WARRANTY SERVICE OR REPAIR:

Contact the installer or a Carrier dealer. You may be able to find the installer's name on the equipment or in your Owner's Packet. You can also find a Carrier dealer online at *www.carrier.com*

For help, contact: Carrier Corporation, Consumer Relations**,** P.O. Box 4808, Syracuse, New York 13221, Phone 1-800-227-7437

PRODUCT REGISTRATION: You can register your product online at *www.carrier.com.*

Model Number_____ Serial Number _____

Date of Installation _____ Installed by _____

Name of Owner _____ Address of Installation _____

Carrier Corporation (hereinafter "Company") warrants this product against failure due to defect in materials or workmanship under normal use and maintenance as follows. All warranty periods begin on the date of original installation. If a part fails due to defect during the applicable warranty period Company will provide a new or remanufactured part, at Company's option, to replace the failed defective part at no charge for the part. Alternatively, and at its option, the Company will provide a credit in the amount of the then factory selling price for a new equivalent part toward the retail purchase price of a new Company product. Except as otherwise stated herein, those are Company's exclusive obligations under this warranty for a product failure. This limited warranty is subject to all provisions, conditions, limitations and exclusions listed below and on the reverse (if any) of this document.

OWNER-OCCUPIED, RESIDENTIAL APPLICATIONS
This warranty is to the original purchasing owner and is transferable only to the extent and as stated in the Warranty Conditions and below. The warranty period in years, depending on the part and the claimant, is as shown in the chart below.

		Limited Warranty (Years)	
Product	Item	Original Owner	Subsequent Owner
Air Conditioner or Heat Pump Condensing Unit	Parts	10* (or 5)	5
	Compressor	10* (or 5)	5

* For products with R-410A refrigerant only, if properly registered within 90 days, otherwise 5 years (except in California and Quebec and other jurisdictions that prohibit warranty benefits conditioned on registration, registration is not required to obtain longer warranty periods). See Warranty Conditions below.

OTHER RESIDENTIAL APPLICATIONS (Apartments, Rental Properties, etc.)
The warranty period is five (5) years on parts. The warranty is to the original owner only and is not transferable.

OTHER APPLICATIONS
The warranty period is five (5) years on the compressor, and one (1) year on all other parts. The warranty is to the original owner only and is not transferable.

LEGAL REMEDIES - The owner **must** notify the Company in writing, by certified or registered letter to Carrier Corporation, Warranty Claims, P.O. Box 4808, Syracuse, New York 13221, of any defect or complaint with the product, stating the defect or complaint and a specific request for repair, replacement, or other correction of the product under warranty, mailed at least thirty (30) days before pursuing any legal rights or remedies.

Always Ask For FACTORY AUTHORIZED PARTS

CARRIER CORPORATION

WARRANTY CONDITIONS:

1. To obtain the longer warranty periods as shown in the table under original owner, for the original purchaser, the product must be properly registered at *www.carrier.com* within ninety (90) days of original installation. In jurisdictions where warranty terms conditioned on registration are prohibited by law, registration is not required and the longer warranty period shown will apply.
2. Where a product is installed in a newly constructed home, the date of installation is the date the homeowner purchased the home from the builder.
3. If the date of original installation cannot be verified, then the warranty period begins ninety (90) days from the date of product manufacture (as indicated by the model and serial number). Proof of purchase may be required at time of service.
4. The remainder of the first five years of warranty is freely transferable without registration.
5. Product must be installed properly and by a licensed HVAC technician.
6. The warranty applies only to products remaining in their original installation location.
7. Installation, use, care, and maintenance must be normal and in accordance with instructions contained in the Installation Instructions, Owner's Manual and Company's service information.
8. Defective parts must be returned to the distributor through a registered servicing dealer for credit.

LIMITATIONS OF WARRANTIES: ALL IMPLIED WARRANTIES AND/OR CONDITIONS (INCLUDING IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE OR PURPOSE) ARE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY. SOME STATES OR PROVINCES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY OR CONDITION LASTS, SO THE ABOVE MAY NOT APPLY TO YOU. THE EXPRESS WARRANTIES MADE IN THIS WARRANTY ARE EXCLUSIVE AND MAY NOT BE ALTERED, ENLARGED, OR CHANGED BY ANY DISTRIBUTOR, DEALER, OR OTHER PERSON, WHATSOEVER.

THIS WARRANTY DOES NOT COVER:

1. Labor or other costs incurred for diagnosing, repairing, removing, installing, shipping, servicing or handling of either defective parts, or replacement parts, or new units.
2. Any product purchased over the Internet.
3. Normal maintenance as outlined in the installation and servicing instructions or Owner's Manual, including filter cleaning and/or replacement and lubrication.
4. Failure, damage or repairs due to faulty installation, misapplication, abuse, improper servicing, unauthorized alteration or improper operation.
5. Failure to start or damages due to voltage conditions, blown fuses, open circuit breakers, or the inadequacy, unavailability, or interruption of electrical, internet service provider, or mobile device carrier service or your home network.
6. Failure or damage due to floods, winds, fires, lightning, accidents, corrosive environments (rust, etc) or other conditions beyond the control of Company.
7. Parts not supplied or designated by Company, or damages resulting from their use.
8. Products installed outside the U.S.A. or its territories and Canada.
9. Electricity or fuel costs, or increases in electricity or fuel costs from any reason whatsoever, including additional or unusual use of supplemental electric heat.
10. Any cost to replace, refill or dispose of refrigerant, including the cost of refrigerant.
11. **ANY SPECIAL, INDIRECT OR CONSEQUENTIAL PROPERTY OR COMMERCIAL DAMAGE OF ANY NATURE WHATSOEVER.** Some states or provinces do not allow the exclusion of incidental or consequential damages, so the above limitation may not apply to you.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state or province to province.

Always Ask For FACTORY AUTHORIZED PARTS

Bardi
24/7 Heating & Air Conditioning
The Climate's Always Right With Bardi

Section #4

Fan Coil Unit Warranty

Carrier

Limited Warranty for Fan Coil

FOR WARRANTY SERVICE OR REPAIR:

Contact the installer. You may find the installer's name on the equipment or in your Owner's Packet.

For help, contact: CAC / BDP, Consumer Relations**,** P.O. Box 4808, Syracuse, New York 13221, Phone 1-800-227-7437

PRODUCT REGISTRATION: You can register your product online at *www.cac-bdp.com*.

Model No. _____ Unit Serial No. _____

Date of Installation _____ Installed by _____

Name of Owner _____ Address of Installation _____

CAC / BDP (hereinafter "Company") warrants this product against failure due to defect in materials or workmanship under normal use and maintenance as follows. All warranty periods begin on the date of original installation. If a part fails due to defect during the applicable warranty period Company will provide a new or remanufactured part, at Company's option, to replace the failed defective part at no charge for the part. Alternatively, and at its option, the Company will allow a credit in the amount of the then factory selling price for a new equivalent part toward the retail purchase price of a new Company product. Except as otherwise stated herein, those are Company's exclusive obligations under this warranty for a product failure. This limited warranty is subject to all provisions, conditions, limitations and exclusions listed below and on the reverse (if any) of this document.

OWNER-OCCUPIED, RESIDENTIAL APPLICATIONS
This warranty is to the original purchasing owner and is transferable only to the extent and as stated in the Warranty Conditions and below. The warranty period in years, depending on the part and the claimant, is as shown in the chart below.

		Limited Warranty (Years)	
Product	Item	Original Owner	Subsequent Owner
Fan Coil	Parts	10* (or 5)	10** (or 5)

* If properly registered within 90 days, otherwise 5 years (except in California and Quebec and other jurisdictions that prohibit warranty benefits conditioned on registration, registration is not required to obtain longer warranty periods). See Warranty Conditions below.
** If properly transferred within 90 days, otherwise 5 years. See Warranty Conditions below. In California and Quebec and other jurisdictions that prohibit warranty benefits conditioned on registration, registration is not required for a transfer and all warranty periods for subsequent owners are five years from original installation.

OTHER RESIDENTIAL APPLICATIONS (Apartments, Rental Properties, etc.)
The warranty period is five (5) years and is not transferable.

OTHER APPLICATIONS
This warranty is non-transferable. The warranty period is one (1) year.

LEGAL REMEDIES - The owner **must** notify the Company in writing, by certified or registered letter to CAC / BDP, Warranty Claims, P.O. Box 4808, Syracuse, New York 13221, of any defect or complaint with the product, stating the defect or complaint and a specific request for repair, replacement, or other correction of the product under warranty, mailed at least thirty (30) days before pursuing any legal rights or remedies.

WARRANTY CONDITIONS:

1. To obtain the longer warranty periods as shown in the table under original owner, for the original purchaser, the product must be properly registered at *www.cac-bdp.com* within ninety (90) days of original installation. In jurisdictions where warranty terms conditioned on registration are prohibited by law, registration is not required and the longer warranty period shown will be apply.
2. Where a product is installed in a newly constructed home, the date of installation is the date the homeowner purchased the home from the builder.
3. If the date of original installation cannot be verified, then the warranty period begins ninety (90) days from the date of product manufacture (as indicated by the model and serial number). Proof of purchase may be required at time of service.
4. The remainder of the first five years of warranty is freely transferable without registration. To obtain a transfer of the longer warranty periods as shown in the table under subsequent owner, a subsequent owner must register the transfer at *www.cac-bdp.com* within 90 days of the change in ownership and payment of a transfer fee. Not applicable in all jurisdictions. See website for details.
5. Product must be installed properly and by a licensed HVAC technician.
6. The warranty applies only to products remaining in their original installation location.
7. Installation, use, care, and maintenance must be normal and in accordance with instructions contained in the Installation Instructions, Owner's Manual and Company's service information.
8. Defective parts must be returned to the distributor through a registered servicing dealer for credit.

LIMITATIONS OF WARRANTIES: ALL IMPLIED WARRANTIES AND/OR CONDITIONS (INCLUDING IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE OR PURPOSE) ARE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY. SOME STATES OR PROVINCES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY OR CONDITION LASTS, SO THE ABOVE MAY NOT APPLY TO YOU. THE EXPRESS WARRANTIES MADE IN THIS WARRANTY ARE EXCLUSIVE AND MAY NOT BE ALTERED, ENLARGED, OR CHANGED BY ANY DISTRIBUTOR, DEALER, OR OTHER PERSON, WHATSOEVER.

THIS WARRANTY DOES NOT COVER:

1. Labor or other costs incurred for diagnosing, repairing, removing, installing, shipping, servicing or handling of either defective parts, or replacement parts, or new units.
2. Any product purchased over the Internet.
3. Normal maintenance as outlined in the installation and servicing instructions or Owner's Manual, including filter cleaning and/or replacement and lubrication.
4. Failure, damage or repairs due to faulty installation, misapplication, abuse, improper servicing, unauthorized alteration or improper operation.
5. Failure to start due to voltage conditions, blown fuses, open circuit breakers, or damages due to the inadequacy or interruption of electrical service.
6. Failure or damage due to floods, winds, fires, lightning, accidents, corrosive environments (rust, etc) or other conditions beyond the control of Company.
7. Parts not supplied or designated by Company, or damages resulting from their use.
8. Products installed outside the U.S.A. or its territories and Canada.
9. Electricity or fuel costs, or increases in electricity or fuel costs from any reason whatsoever, including additional or unusual use of supplemental electric heat.
10. Any cost to replace, refill or dispose of refrigerant, including the cost of refrigerant.
11. **ANY SPECIAL, INDIRECT OR CONSEQUENTIAL PROPERTY OR COMMERCIAL DAMAGE OF ANY NATURE WHATSOEVER.** Some states or provinces do not allow the exclusion of incidental or consequential damages, so the above limitation may not apply to you.

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state or province to province.

MECHANICAL ABBREVIATIONS

ABBREVIATION/DEFINITION		ABBREVIATION/DEFINITION	
A/C	ABOVE CEILING	IN. WC	INCHES WATER COLUMN
AFF	ABOVE FINISHED FLOOR	LAT	LEAVING AIR TEMPERATURE (°F)
AHU	AIR HANDLING UNIT	MBH	1000 BRITISH THERMAL UNITS PER HOUR
CFM	CUBIC FEET PER MINUTE	MD	MANUAL DAMPER
CHP	CHILLED WATER PUMP	MOD	MOTOR OPERATED DAMPER
CHR	CHILLED WATER RETURN	MU	MAKE-UP WATER
CHS	CHILLED WATER SUPPLY	OA	OUTSIDE AIR
C.T.E.	CONNECT TO EXISTING	PD	PRESSURE DROP
CWP	CONDENSER WATER PUMP	PRV	PRESSURE REDUCING VALVE
D	CONDENSATE DRAIN	RA	RETURN AIR
DB	DRY BULB TEMPERATURE (°F)	RH	ROOF HOOD
EAT	ENTERING AIR TEMPERATURE (°F)	SB	SECURITY BARS
EF	EXHAUST FAN	SMD	SMOKE DAMPER
ESP	EXTERNAL STATIC PRESSURE	SPS	DUCT MOUNTED STATIC PRESSURE SENSOR
FD	FIRE DAMPER	SPD	SPLITTER DAMPER
HP	HEAT PUMP	VFD	VARIABLE FREQUENCY DRIVE
HWC	HOT WATER COIL	WB	WET BULB TEMPERATURE (°F)
HWP	HOT WATER PUMP	WL	WALL LOUVER
HWR	HOT WATER RETURN	W.O.	WALL OPENING
HWS	HOT WATER SUPPLY		

NOTE: THESE ARE STANDARD ABBREVIATIONS, ALL ABBREVIATIONS SHOWN ABOVE MAY NOT APPEAR ON DRAWINGS.

MECHANICAL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CEILING	T	THERMOSTAT OR TEMERATURE SENSOR
	DUCT	H	HUMIDISTAT OR HUMIDITY SENSOR
	EXISTING	S	WALL MOUNTED SWITCH
	PIPING		FLEXIBLE DUCTWORK
EQ #	EQUIPMENT DESIGNATION		MANUAL DAMPER
			FIRE DAMPER
A B C	AIR DISTRIBUTION TAG A. TYPE B. SIZE C. CFM		DUCT WITH LINER
			DUCT TRANSITION
#x#	DUCT SIZE - RECTANGULAR (INCHES)		SQUARE TO ROUND DUCT TRANSITION
#"ø	DUCT SIZE - ROUND (INCHES)	SPS	DUCT MOUNTED STATIC PRESSURE SENSOR
	DIFFUSER	SD	DUCT MOUNTED SMOKE DETECTOR
			WALL OPENING
	REUTRN AIR DISTRIBUTION DEVICE		SECURITY BARS
			WALL LOUVER
	EXHAUST AIR DISTRIBUTION DEVICE	S	SMOKE DAMPER
	DUCTWORK (POSITIVE PRESSURE)	M	MOTOR OPERATED DAMPER
			SPLITTER DAMPER
	DUCTWORK (NEGATIVE PRESSURE)		SUPPLY AIR ARROW
			RETURN AIR ARROW
	CONNECT TO EXISTING		
	DUCTWORK - EXISTING TO REMAIN		REMOVE EXISTING DUCTWORK

NOTE: THIS IS A STANDARD LEGEND. ALL ITEMS SHOWN MAY NOT APPEAR ON DRAWINGS.

SPECIFICATIONS

1. REFER TO OTHER DRAWINGS AND SPECIFICATIONS. CONTRACTOR SHALL BE RESPONSIBLE FOR APPLICABLE PROVISIONS THEREIN.
2. FURNISH AND INSTALL NECESSARY LABOR AND MATERIALS FOR A COMPLETE SYSTEM. ANY APPLIANCES OR MATERIALS OBVIOUSLY A PART OF THE SYSTEM AND NECESSARY FOR ITS PROPER OPERATION, ALTHOUGH NOT SPECIFICALLY MENTIONED HEREIN, SHALL BE FURNISHED AND INSTALLED AS IF CALLED FOR IN DETAIL.
3. WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE FOLLOWING STATE AND LOCAL CODES:
   THE INTERNATIONAL BUILDING CODE, 2006 EDITION WITH GEORGIA AMENDMENTS
   THE INTERNATIONAL MECHANICAL CODE, 2006 EDITION WITH GEORGIA AMENDMENTS
   THE INTERNATIONAL ENERGY CONSERVATION CODE, 2009 EDITION WITH GEORGIA AMENDMENTS
4. OBTAIN AND PAY FOR REQUIRED PERMITS AND FEES.
5. DRAWINGS ARE GENERALLY DIAGRAMMATIC AND DO NOT NECESSARILY SHOW EVERY FITTING AND DETAIL. INSTALL DUCTS, EQUIPMENT AND CONTROLS IN A NEAT WORKMANLIKE MANNER, AND IN ACCORDANCE WITH GOOD PRACTICE FOR A COMPLETE WORKABLE INSTALLATION. AVOID CONFLICT WITH OTHER WORK; MAKE ADEQUATE PROVISIONS FOR PREVENTING NOISE AND VIBRATION. ARRANGE EQUIPMENT INTO THE AVAILABLE SPACE IN A MANNER TO MAKE WORKING PARTS ACCESSIBLE FOR MAINTENANCE AND SERVICE.
6. MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED AGAINST DEFECTS FOR ONE YEAR. PROVIDE ADDITIONAL FOUR-YEAR WARRANTY ON COMPRESSORS.
7. PROTECT MATERIALS AND EQUIPMENT FROM DAMAGE DURING CONSTRUCTION.
8. EQUIPMENT AND MATERIALS SHALL BE NEW, UNLESS OTHERWISE SPECIFIED.
9. CONSTRUCT AIR DUCTS IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS, LATEST EDITION. DUCTWORK MATERIALS SHALL BE GALVANIZED SHEET METAL.
10. ELECTRICAL - DISCONNECTS AND/OR BREAKERS, POWER WIRING THRU MOTOR CONTROL DEVICES TO MOTORS OR TO JUNCTION BOXES OF FACTORY WIRED EQUIPMENT ARE PROVIDED UNDER THE ELECTRICAL DIVISION OF WORK. MECHANICAL WORK SHALL INCLUDE CONTROL AND INTERLOCK WIRING REQUIRED FOR PROPER OPERATION OF THE SYSTEM, AND SHALL INCLUDE FURNISHING OF MAGNETIC STARTERS OR CONTACTORS WHERE REQUIRED.
11. COORDINATE VOLTAGE AND PHASE OF EACH PIECE OF EQUIPMENT WITH ELECTRICAL CONTRACTOR BEFORE ORDERING.
12. LOCATIONS SHOWN FOR EQUIPMENT ARE APPROXIMATE LOCATIONS. CONTRACTOR SHALL COORDINATE WITH THE FIELD CONDITIONS FOR THE EXACT LOCATION AND CONFIGURATION, AND MODIFY DUCT SYSTEM ACCORDINGLY.
13. CONTRACTOR SHALL FIELD VERIFY AVAILABLE SPACE FOR DUCTWORK BEFORE FABRICATING. CONTRACTOR SHALL MODIFY DUCTWORK TO FIT AVAILABLE FIELD CONDITIONS. CUTTING OR OTHERWISE ALTERING ANY STRUCTURAL MEMBERS SHALL NOT BE PERMITTED WITHOUT WRITTEN PERMISSION FROM THE ARCHITECT.
14. PRIOR TO INSTALLATION AND ORDERING, SUBMIT FOR REVIEW FIVE COPIES OF SHOP DRAWINGS ON EQUIPMENT, AIR DISTRIBUTION DEVICES, AND CONTROLS.
15. INTERRUPTION OF SERVICE: THE DRAWINGS ARE BELIEVED TO BE A FAIRLY ACCURATE REPRESENTATION OF THE EXISTING WORK. HOWEVER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ON SITE INVESTIGATIONS TO DETERMINE THE ACCURACY OF THE EXISTING CONDITION DRAWINGS. NO ATTEMPT HAS BEEN MADE TO SHOW ON THE DRAWINGS MECHANICAL WORK WHICH IS NOT CONSIDERED TO BE RELEVANT TO THIS PROJECT. IN PERFORMANCE OF THE WORK, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY EXISTING CONDITIONS AND THE EFFECT THAT THE WORK SHOWN ON THE DRAWINGS WILL HAVE ON THE EXISTING SERVICES. SHOULD THE ACTUAL CONDITIONS BE DIFFERENT FROM THOSE SHOWN ON THE DRAWINGS, THE CONTRACTOR SHALL NOTIFY THE OWNER FOR FURTHER INSTRUCTIONS PRIOR TO THE DISRUPTION OF THE EXISTING SERVICES.
16. EQUIPMENT SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

GENERAL NOTES

1. COORDINATE WORK WITH OTHER TRADES PRIOR TO INSTALLATION.
2. DUCT SIZES SHOWN ARE INSIDE CLEAR DIMENSIONS.
3. FOR NEW UNITS IN THIS SCOPE OF WORK, PROVIDE A 7-DAY PROGRAMMABLE, AUTOMATIC CHANGEOVER THERMOSTAT WITH 50 FEET OF ADDITIONAL CONTROL WIRING IN THE SPACE. COIL WIRING AND LOCATE WITH THERMOSTAT AT INTERIOR UNITS, OR ON WALL ADJACENT TO EXTERIOR UNITS.
4. REFRIGERANT PIPING SHALL BE SIZED BASED ON MANUFACTURERS REQUIREMENTS, COORDINATED WITH LINESET LENGTHS, AND INSULATED WITH 1" THICK FLEXIBLE CELLULAR PIPE INSULATION.
5. REMOVE EXISTING CEILING TO THE EXTENT REQUIRED FOR THE NEW WORK SHOWN ON THE DRAWINGS. REMOVE EXISTING CEILING BELOW NEW MECHANICAL EQUIPMENT

SPLIT SYSTEM HEAT PUMPS

MARK	AIR UNIT					COOLING CYCLE		HEATING CYCLE		HEAT PUMP
	CFM	O.A. CFM	ESP (IN W.C.)	SUPPLEMENTAL HEAT CAPACITY (MIN. KW)	VOLT/ PHASE	NOMINAL CAPACITY (TONS)	MIN. SEER	NOMINAL CAPACITY (MBH@47°F)	MIN. COP	ELEC. CONNECTION VOLT/ PHASE
AU-1 / HP-1	1900	35	0.75	18	208 / 3	5.0	13	56.0	3.8	208 / 1
AU-2 / HP-2	800	35	0.75	7.2	208 / 3	2.0	13	24.0	3.8	208 / 1

NOTES:
AIR UNITS SHALL BE JOHNSON CONTROLS AVY, OR EQUAL BY TRANE OR CARRIER.
HEAT PUMPS SHALL BE JOHNSON CONTROLS YZB, OR EQUAL BY TRANE OR CARRIER.

AS-BUILTS

Covalent Consulting,LLC
1708 Peachtree St.
Suite 210
Atlanta, GA 30309
404/355-9334 main
404/835-1118 fax

SUITE A06/A07 LANDLORD WORK
WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

GEORGIA REGISTERED NO. 25559 PROFESSIONAL ENGINEER PATRICK C. WILKES

DOCUMENT ISSUE RECORD

NO	DATE	DESCRIPTION
1	9-12-13	FOR CONSTRUCTION
2	9-18-13	REVISIONS
3	11-08-13	REVISIONS

PROJECT NO.
13-072
SCALE
AS SHOWN
SHEET TITLE
MECHANICAL SPECIFICATIONS
SHEET NO
M0.1

EXISTING OUTSIDE AIR DUCTWORK TO REMAIN IN SERVICE FOR A07

NEW 10"ø OUTSIDE AIR DUCTWORK WITH WALL CAP FOR ADDITIONAL UNIT IN A07. COORDINATE ROUTING AND INSTALLATION WITH EXISTING CONDITIONS.

EXISTING EXHAUST AIR DUCTWORK TO REMAIN FOR A07 SERVICE

UP TO MECHANICAL ROOM

ROUTE REFRIGERANT LINESETS TIGHT TO STRUCTURE

AU 1

ROUTE CONDENSATE DRAINS TO NEW HUB DRAIN

SUSPENDED ABOVE EXISTING CEILING. REMOVE CEILING AS NEEDED FOR INSTALLATION AND ACCESS. PROVIDE 24" RETURN AIR INLET WITH DUCT OPENING FOR RETURN AIR AND 10"ø OUTSIDE AIR DUCT CONNECTION. TRAP AND ROUTE CONDENSATE DRAIN LINE TO HUB DRAIN.

EXISTING AIR DISTRIBUTION SYSTEM WITHIN TENANT AREA A07 TO REMAIN.

EXISTING CEILING AND DIFFUSERS TO REMAIN

A07

EXISTING OUTSIDE AIR DUCTWORK TO REMAIN IN SERVICE FOR A06

NEW 8"ø EXHAUST WITH WALL CAP

RELOCATED EXHAUST FAN

EXISTING FAN COIL UNIT ABOVE CEILING TO REMAIN IN SERVICE, MATCHING 4-TON HEAT PUMP IN SECOND FLOOR MECHANICAL ROOM TO REMAIN. MODIFY EXISTING CONDENSATE DRAIN LINE TO TERMINATE AT NEW HUB DRAIN WITHIN A07 TENANT AREA. SEE COORDINATE WITH PLUMBING SERVICES.

EXISTING EXHAUST GRILLES AND DUCT SYSTEMS TO REMAIN IN SERVICE

NEW 8"ø OUTSIDE AIR DUCTWORK ROUTED TO EXISTING OUTSIDE AIR DUCTWORK. COORDINATE ROUTING AND INSTALLATION WITH EXISTING CONDITIONS.

ROUTE REFRIGERANT LINESETS TIGHT TO STRUCTURE

CONDENSATE DRAIN.

AU 2

ROUTING OF EXISTING DUCTWORK IS APPROXIMATE. FIELD VERIFY CONDITIONS ABOVE CEILING PRIOR TO WORK.

EXISTING FAN COIL UNIT ABOVE CEILING TO REMAIN IN SERVICE, MATCHING 5-TON HEAT PUMP IN SECOND FLOOR MECHANICAL ROOM TO REMAIN.

SUSPENDED ABOVE EXISTING CEILING. REMOVE CEILING AS NEEDED FOR INSTALLATION AND ACCESS. PROVIDE 24" RETURN AIR INLET WITH DUCT OPENING FOR RETURN AIR AND 10"ø OUTSIDE AIR DUCT CONNECTION. TRAP AND ROUTE CONDENSATE DRAIN LINE TO EXISTING DRAIN.

EXISTING CEILING AND DIFFUSERS TO REMAIN

EXISTING AIR DISTRIBUTION SYSTEM WITHIN TENANT AREA A06 TO REMAIN.

A06

1 FIRST FLOOR PLAN - MECHANICAL
Scale: 1/4" = 1'-0"

AS-BUILTS

SUITE A06/A07 LANDLORD WORK

WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

Covalent Consulting,LLC
1708 Peachtree St.
Suite 210
Atlanta, GA 30309
404/355-9334 main
404/835-1118 fax

GEORGIA REGISTERED NO. 25559 PROFESSIONAL ENGINEER PATRICK C. WILKES

DOCUMENT ISSUE RECORD

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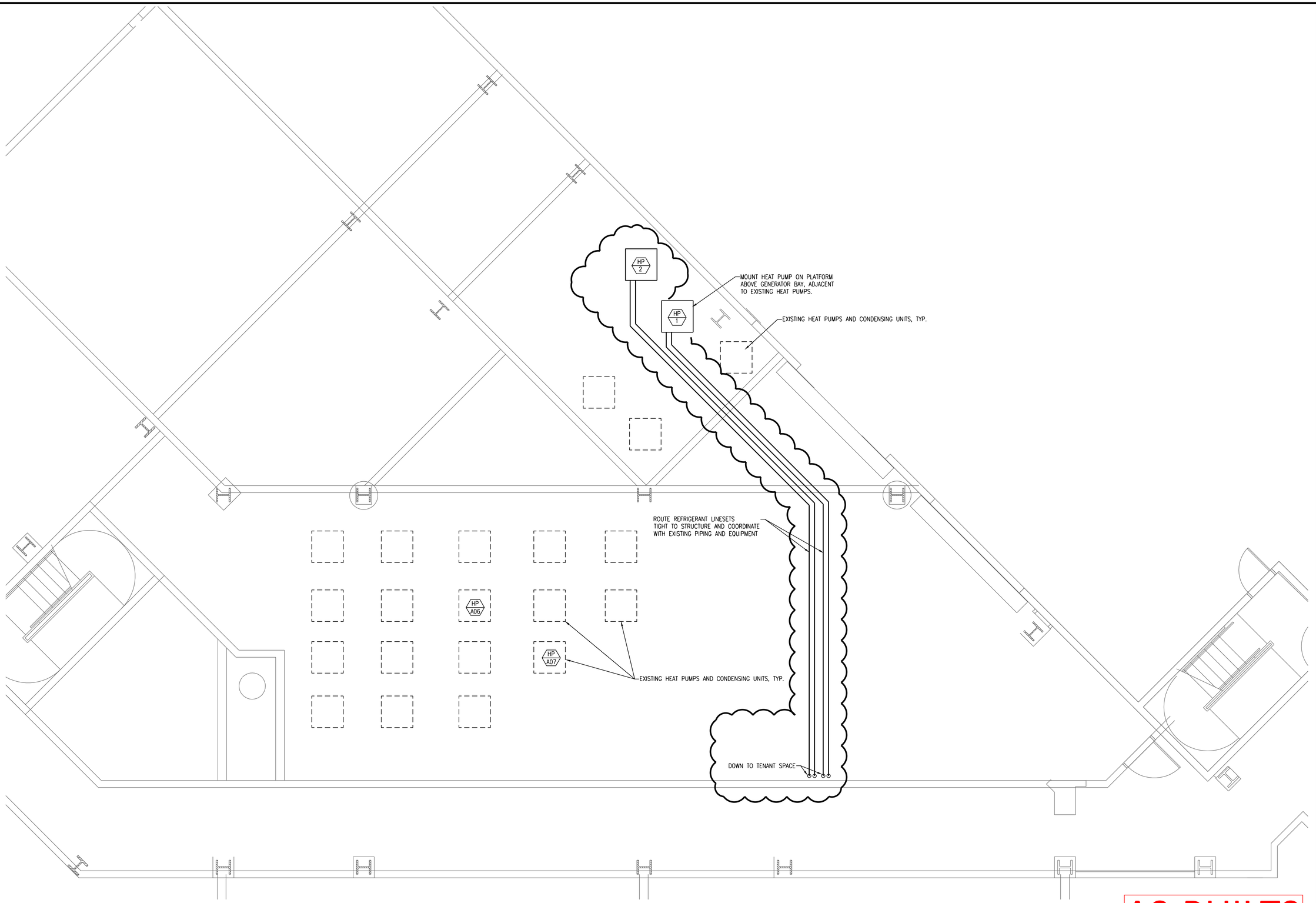
2	9-18-13	REVISIONS
3	11-08-13	REVISIONS

PROJECT NO.
13-072

SCALE
AS SHOWN

SHEET TITLE
MECHANICAL
NEW WORK PLAN
FIRST FLOOR

SHEET NO
M2.0



1 SECOND FLOOR PLAN - MECHANICAL
Scale: 1/4" = 1'-0"

AS-BUILTS

Covalent Consulting,LLC
1708 Peachtree St.
Suite 210
Atlanta, GA 30309
404/355-9334 main
404/835-1118 fax

SUITE A06/A07 LANDLORD WORK

WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

GEORGIA REGISTERED NO. 25559 PROFESSIONAL ENGINEER PATRICK C. WILKES

DOCUMENT ISSUE RECORD

NO	DATE	DESCRIPTION
1	9-12-13	FOR CONSTRUCTION
2	9-18-13	REVISIONS
3	11-08-13	REVISIONS

PROJECT NO.
13-072

SCALE
AS SHOWN

SHEET TITLE
MECHANICAL
NEW WORK PLAN
SECOND FLOOR

SHEET NO
M2.1

DEC 30 2013

RECEIVED

EXHIBIT "D"
SUBCONTRACTOR/VENDOR WARRANTY FORM

PROJECT: **WHTIE PROVISION – LANDLORDS WORK SUITE A06/A07**

OWNER: **WHITE PROVISION REDEVELOPEMENT, L.P.**

GENERAL CONTRACTOR: Derucki Construction Company, LLC

We, PUTZEL ELECTRIC, Subcontractor /Vendor for WHITE PROVISION SUITE A06/A07 described in Specification Section(s) Reference Subcontract Exhibit A Do hereby warrant that all labor and materials furnished and work performed in conjunction with the above referenced project are in accord with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials and workmanship for a period of **ONE YEAR** from Date of Acceptance. This warranty commences on **12/20/2013** and expires on **12/20/2014.**

Should any defect develop during the warranty period due to improper material, workmanship, or arrangement, the same shall, upon written notice by the Owner, be made good by the undersigned at no expense to the Owner. Nothing in the above shall be deemed to apply to work which has been abused or neglected by the Owner.

DATE: 12-23-13

FOR: Putzel Electric

BY: _____

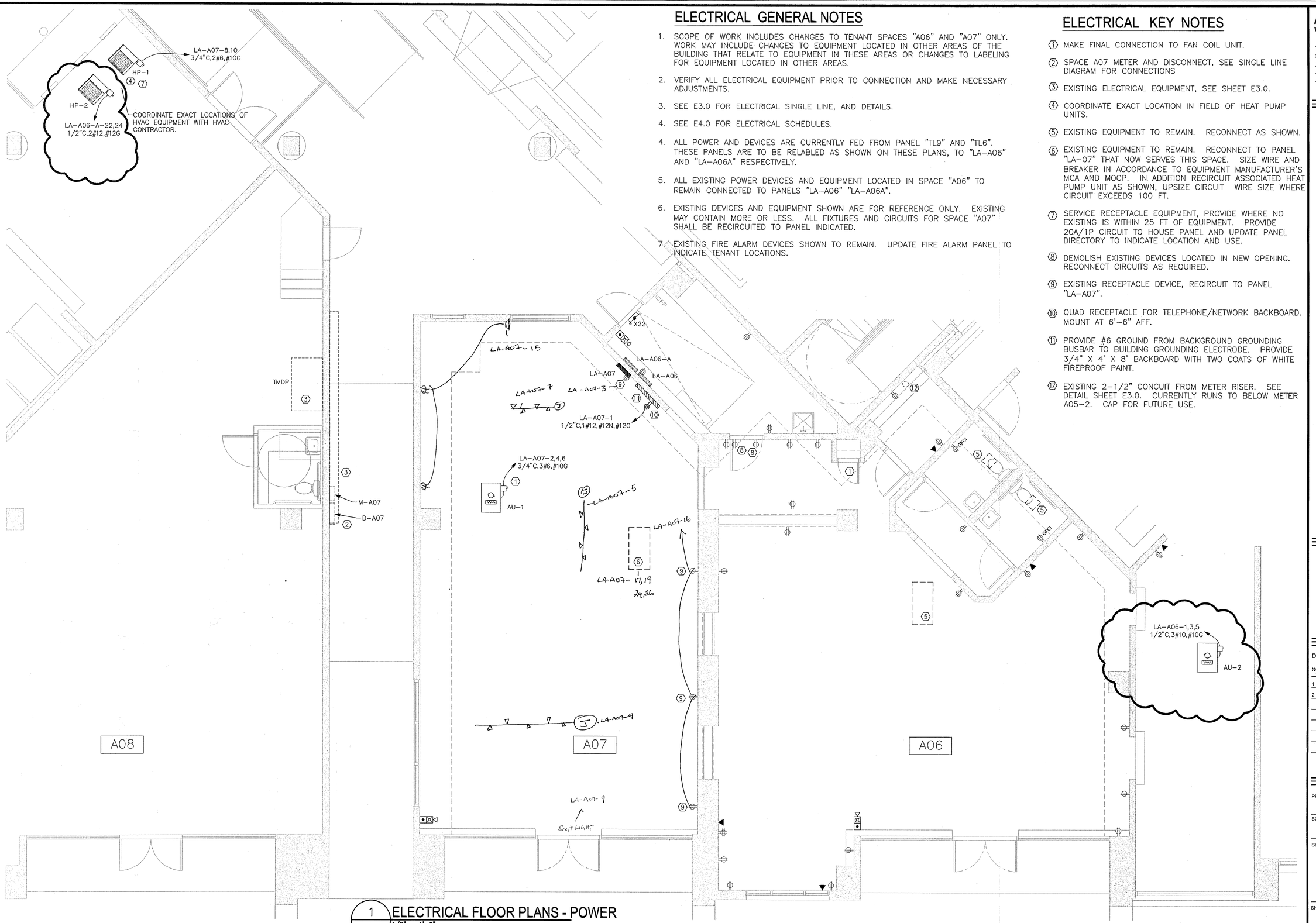
TITLE: _____

Sworn to and subscribed before me this 23rd day of December 2013

_____
Notary Public

My Commission Expires: _____

MARY ANN STATLER NOTARY PUBLIC CHEROKEE COUNTY, GEORGIA MY COMMISSION EXPIRES MAY 11, 2014



1 E2.0 — ELECTRICAL FLOOR PLANS - POWER
1/8" = 1'–0"

ELECTRICAL GENERAL NOTES

1. SCOPE OF WORK INCLUDES CHANGES TO TENANT SPACES "A06" AND "A07" ONLY. WORK MAY INCLUDE CHANGES TO EQUIPMENT LOCATED IN OTHER AREAS OF THE BUILDING THAT RELATE TO EQUIPMENT IN THESE AREAS OR CHANGES TO LABELING FOR EQUIPMENT LOCATED IN OTHER AREAS.
2. VERIFY ALL ELECTRICAL EQUIPMENT PRIOR TO CONNECTION AND MAKE NECESSARY ADJUSTMENTS.
3. SEE E3.0 FOR ELECTRICAL SINGLE LINE, AND DETAILS.
4. SEE E4.0 FOR ELECTRICAL SCHEDULES.
4. ALL POWER AND DEVICES ARE CURRENTLY FED FROM PANEL "TL9" AND "TL6". THESE PANELS ARE TO BE RELABLED AS SHOWN ON THESE PLANS, TO "LA–A06" AND "LA–A06A" RESPECTIVELY.
5. ALL EXISTING POWER DEVICES AND EQUIPMENT LOCATED IN SPACE "A06" TO REMAIN CONNECTED TO PANELS "LA–A06" "LA–A06A".
6. EXISTING DEVICES AND EQUIPMENT SHOWN ARE FOR REFERENCE ONLY. EXISTING MAY CONTAIN MORE OR LESS. ALL FIXTURES AND CIRCUITS FOR SPACE "A07" SHALL BE RECIRCUITED TO PANEL INDICATED.
7. EXISTING FIRE ALARM DEVICES SHOWN TO REMAIN. UPDATE FIRE ALARM PANEL TO INDICATE TENANT LOCATIONS.

ELECTRICAL KEY NOTES

1. MAKE FINAL CONNECTION TO FAN COIL UNIT.
2. SPACE A07 METER AND DISCONNECT, SEE SINGLE LINE DIAGRAM FOR CONNECTIONS
3. EXISTING ELECTRICAL EQUIPMENT, SEE SHEET E3.0.
4. COORDINATE EXACT LOCATION IN FIELD OF HEAT PUMP UNITS.
5. EXISTING EQUIPMENT TO REMAIN. RECONNECT AS SHOWN.
6. EXISTING EQUIPMENT TO REMAIN. RECONNECT TO PANEL "LA–07" THAT NOW SERVES THIS SPACE. SIZE WIRE AND BREAKER IN ACCORDANCE TO EQUIPMENT MANUFACTURER'S MCA AND MOCP. IN ADDITION RECIRCUIT ASSOCIATED HEAT PUMP UNIT AS SHOWN, UPSIZE CIRCUIT WIRE SIZE WHERE CIRCUIT EXCEEDS 100 FT.
7. SERVICE RECEPTACLE EQUIPMENT, PROVIDE WHERE NO EXISTING IS WITHIN 25 FT OF EQUIPMENT. PROVIDE 20A/1P CIRCUIT TO HOUSE PANEL AND UPDATE PANEL DIRECTORY TO INDICATE LOCATION AND USE.
8. DEMOLISH EXISTING DEVICES LOCATED IN NEW OPENING. RECONNECT CIRCUITS AS REQUIRED.
9. EXISTING RECEPTACLE DEVICE, RECIRCUIT TO PANEL "LA–A07".
10. QUAD RECEPTACLE FOR TELEPHONE/NETWORK BACKBOARD. MOUNT AT 6'–6" AFF.
11. PROVIDE #6 GROUND FROM BACKGROUND GROUNDING BUSBAR TO BUILDING GROUNDING ELECTRODE. PROVIDE 3/4" X 4' X 8' BACKBOARD WITH TWO COATS OF WHITE FIREPROOF PAINT.
12. EXISTING 2–1/2" CONCUIT FROM METER RISER. SEE DETAIL SHEET E3.0. CURRENTLY RUNS TO BELOW METER A05–2. CAP FOR FUTURE USE.

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SUITE A06/A07 MODIFICATIONS

WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

GEORGIA REGISTERED No. PE25511 PROFESSIONAL ENGINEER 11-7-13 CRAWFORD G. MURPHY

DOCUMENT ISSUE RECORD

NO	DATE	DESCRIPTION
1	9-12-13	FOR CONSTRUCTION
2	11-08-13	REVISION 1

PROJECT NO.
13-072
SCALE
AS SHOWN
SHEET TITLE
ELECTRICAL FLOOR PLANS - POWER
SHEET NO
E2.0

PANELBOARD SCHEDULE: EXISTING LA-A06

ROOM | VOLTS 208Y/120V 3P 4W | AIC 22,000
MOUNTING FLUSH | BUS AMPS 225 | MAIN BKR MLO
FED FROM TMDP | NEUTRAL 100% | LUGS STANDARD
NOTE * INDICATES EXISTING DEVICES

CKT #	CIRCUIT DESCRIPTION	CKT BKR	KVA LOAD PHASE A	KVA LOAD PHASE B	KVA LOAD PHASE C	CKT BKR	CIRCUIT DESCRIPTION	CKT #
1	(NOTE 1) AU-2	30/3	2.63			40/2	* A/C	2
3		|		2.63		|		4
5		|			2.63	60/2	* A/C	6
7	SPACE	20/1	0			|		8
9	* REC RM 113, 112, 105	20/1		0		20/1	* REC RM 106, 105, 101	10
11	* LIGHTS RM 113 (EMER)	20/1			0	20/1	* REC RM 101,102	12
13	* REC RM 104, 112	20/1	0			20/1	* REC RM 105, 102	14
15	* REC RM 103, 14	20/1		0		20/1	* LIGHTS RM 104	16
17	* REC RM 105, 104	20/1			0	20/1	* LIGHTS RM 105	18
19	* LIGHTS RM 102,103	20/1	0			20/1	* A/C OUTLET	20
21	* REC RM 102,103	20/1		0		20/1	*SPARE	22
23	* DED RM 102 QUAD	20/1			0	20/1	SPACE	24
25	* DED GFI BREAKROOM DISPOSAL	20/1	0			60/2	* A/C	26
27	* DED GFI BREAKROOM	20/1		0		|		28
29	* DED GFI MICROWAVE	20/1			0	60/2	* A/C	30
31	* REC RM 100,106	20/1	0			|		32
33	* LTG RR/GFI	20/1		0		60/2	* A/C	34
35	* LTG RM 111,107, 110	20/1			0	|		36
37	* BATH FANS	20/1	0			100/3	PANEL LA-A06-A	38
39	* TEL BKBD	20/1		0		|		40
41	SPACE	20/1			0	|		42
	TOTAL CONNECTED KVA BY PHASE		2.63	4.21	4.21			
	TOTAL CONNECTED AMPS BY PHASE		21.9	35.9	35.9			

	CONN. KVA	CALC. KVA			CONN. KVA	CALC. KVA	
LIGHTING	0	0	(125%)	CONTINUOUS	0	0	(125%)
LARGEST MOTOR	3.16	3.95	(125%)	HEATING	7.2	7.2	(100%)
OTHER MOTORS	0.694	0.694	(100%)	NONCONTINUOUS	0	0	(100%)
RECEPTACLES	0	0	(50%>10)	KITCHEN EQUIP	0	0	(N/A)
				NONCOIN/DIVERSE	0	0	(N/A)
				TOTAL KVA	11.1	11.8	

UPDATE DIRECTORY TO INDICATE NEW OR RELOCATED CIRCUITS — BALANCED THREE PHASE AMPS 32.9

NOTES:
1) REMOVE NEW BREAKER IN EXISTING SPARE OR SPACE PROVISION. NEW DEVICE SHALL MATCH EXISTING MANUFACTURER, TYPE, CLOSE AND INTERRUPTING RATING SIZE SHOWN. WHERE EXISTING CIRCUIT IS USED INSTALL IN FIRST AVAILABLE EXISTING SPACE OR SPARE. BREAKER SHALL BE SAME STYLE, MANUFACTURER, TYPE AND INTERRUPTING RATING AS EXISTING PANELBOARD.

PANELBOARD SCHEDULE: EXISTING LA-A06-A

ROOM | VOLTS 208Y/120V 3P 4W | AIC 22,000
MOUNTING FLUSH | BUS AMPS 225 | MAIN BKR MLO
FED FROM LA-A06 | NEUTRAL 100% | LUGS STANDARD
NOTE * INDICATES EXISTING DEVICES

CKT #	CIRCUIT DESCRIPTION	CKT BKR	KVA LOAD PHASE A	KVA LOAD PHASE B	KVA LOAD PHASE C	CKT BKR	CIRCUIT DESCRIPTION	CKT #
1	* LIGHTS RM 102	20/1	0			40/2	* SPARE	2
3	* LIGHTS RM 103 (EMER)	20/1		0		|		4
5	* LIGHTS RM 105	20/1			0	60/2	* A/C	6
7	* LIGHTS RM 104	20/1	0			|		8
9	* A/C OUTLET	20/1		0		20/1	* DED GFI REFRIG	10
11	* SPARE	20/1			0	20/1	* DED GFI DISWASHER	12
13	*	20/1	0			20/1	*	14
15	*	20/1		0		20/1	*	16
17	*	20/1			0	20/2	* WATER HEATER	18
19	SPACE	20/1	0			|		20
21	SPACE	20/1		1.58		30/2	(NOTE 1) HP-2	22
23	SPACE	20/1			1.58	|		24
25	SPACE	20/1	0			20/1	SPACE	26
27	SPACE	20/1		0		20/1	SPACE	28
29	SPACE	20/1			0	20/1	SPACE	30
31	SPACE	20/1	0			20/1	SPACE	32
33	SPACE	20/1		0		20/1	SPACE	34
35	SPACE	20/1			0	20/1	SPACE	36
37	SPACE	20/1	0			20/1	SPACE	38
39	SPACE	20/1		0		20/1	SPACE	40
41	SPACE	20/1			0	20/1	SPACE	42
	TOTAL CONNECTED KVA BY PHASE		0	1.58	1.58			
	TOTAL CONNECTED AMPS BY PHASE		0	15.2	15.2			

	CONN. KVA	CALC. KVA			CONN. KVA	CALC. KVA	
LIGHTING	0	0	(125%)	CONTINUOUS	0	0	(125%)
LARGEST MOTOR	3.16	3.95	(125%)	HEATING	0	0	(100%)
OTHER MOTORS	0	0	(100%)	NONCONTINUOUS	0	0	(100%)
RECEPTACLES	0	0	(50%>10)	KITCHEN EQUIP	0	0	(N/A)
				NONCOIN/DIVERSE	0	0	(N/A)
				TOTAL KVA	3.16	3.95	

UPDATE DIRECTORY TO INDICATE NEW OR RELOCATED CIRCUITS — BALANCED THREE PHASE AMPS 11

NOTES:
1) REMOVE NEW BREAKER IN EXISTING SPARE OR SPACE PROVISION. NEW DEVICE SHALL MATCH EXISTING MANUFACTURER, TYPE, CLOSE AND INTERRUPTING RATING SIZE SHOWN. WHERE EXISTING CIRCUIT IS USED INSTALL IN FIRST AVAILABLE EXISTING SPACE OR SPARE. BREAKER SHALL BE SAME STYLE, MANUFACTURER, TYPE AND INTERRUPTING RATING AS EXISTING PANELBOARD.

PANELBOARD SCHEDULE: LA-A07

ROOM | VOLTS 208Y/120V 3P 4W | AIC 22,000
MOUNTING FLUSH | BUS AMPS 225 | MAIN BKR MLO
FED FROM D-A07 | NEUTRAL 100% | LUGS STANDARD
NOTE

CKT #	CIRCUIT DESCRIPTION	CKT BKR	KVA LOAD PHASE A	KVA LOAD PHASE B	KVA LOAD PHASE C	CKT BKR	CIRCUIT DESCRIPTION	CKT #
1	TEL BKBD	20/1	0.4	6.23		50/3	AU-1	2
3	SPACE	20/1		0	6.23	|		4
5	SPACE	20/1			0	6.23	|		6
7	SPACE	20/1	0	3.66		60/2	HP-1	8
9	SPACE	20/1		0	3.66	|		10
11	SPACE	20/1			0	0	20/1	SPACE	12
13	SPACE	20/1	0	0		20/1	SPACE	14
15	SPACE	20/1		0	0	20/1	SPACE	16
17	SPACE	20/1			0	0	20/1	SPACE	18
19	SPACE	20/1	0	0		20/1	SPACE	20
21	SPACE	20/1		0	0	20/1	SPACE	22
23	SPACE	20/1			0	0	20/1	SPACE	24
25	SPACE	20/1	0	0		20/1	SPACE	26
27	SPACE	20/1		0	0	20/1	SPACE	28
29	SPACE	20/1			0	0	20/1	SPACE	30
31	SPACE	20/1	0	0		20/1	SPACE	32
33	SPACE	20/1		0	0	20/1	SPACE	34
35	SPACE	20/1			0	0	20/1	SPACE	36
37	SPACE	20/1	0	0		20/1	SPACE	38
39	SPACE	20/1		0	0	20/1	SPACE	40
41	SPACE	20/1			0	0	20/1	SPACE	42
	TOTAL CONNECTED KVA BY PHASE		9.89	9.89	6.23			
	TOTAL CONNECTED AMPS BY PHASE		84.2	84.2	51.9			

	CONN. KVA	CALC. KVA			CONN. KVA	CALC. KVA	
LIGHTING	0	0	(125%)	CONTINUOUS	0	0	(125%)
LARGEST MOTOR	7.32	9.15	(125%)	HEATING	18	18	(100%)
OTHER MOTORS	0.694	0.694	(100%)	NONCONTINUOUS	0	0	(100%)
RECEPTACLES	0	0	(50%>10)	KITCHEN EQUIP	0	0	(N/A)
				NONCOIN/DIVERSE	0	0	(N/A)
				TOTAL KVA	26	27.8	

BALANCED THREE PHASE AMPS 77.3

LIGHTING FIXTURE SCHEDULE

TYPE	LAMP QUANTITY & TYPE	DESCRIPTION	BALLAST	MOUNTING METHOD	MANUFACTURER & CATALOG SERIES	DESIGN WATTAGE	VOLTAGE/PHASE/WIRE
X	(2) 2W LED/HALOGEN	COMBINATION EGRESS LED EXIT SIGN WITH BATTERY BACHUP WITH SINGLE- OR DOUBLE- FACE AS INDICATED ON DRAWINGS, WHITE THERMOPLASTIC HOUSING, RED LETTERS, UNIVERSAL ARROWS AND UNIVERSAL MOUNTING. FIXTURE SHALL COMPLY WITH NFPA 101-2000 SECTION 5-10.4.1.2. VISIBLE LED LAMPS ARE NOT ACCEPTABLE. PROVIDE INTEGRAL MAINTENANCE-FREE BATTERY PACK FOR MINIMUM 90 MINUTE OPERATION.	N/A	CEILING	LITHONIA EXR LED EL M6	25	120V 1P 2W

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SUITE A06/A07 MODIFICATIONS
WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

DOCUMENT ISSUE RECORD

NO	DATE	DESCRIPTION
1	9-12-13	FOR CONSTRUCTION
2	11-08-13	REVISION 1

PROJECT NO.
13-072

SCALE
AS SHOWN

SHEET TITLE
ELECTRICAL SCHEDULES

SHEET NO
E4.0

MECHANICAL ABBREVIATIONS

ABBREVIATION/DEFINITION		ABBREVIATION/DEFINITION	
A/C	ABOVE CEILING	IN. WC	INCHES WATER COLUMN
AFF	ABOVE FINISHED FLOOR	LAT	LEAVING AIR TEMPERATURE (°F)
AHU	AIR HANDLING UNIT	MBH	1000 BRITISH THERMAL UNITS PER HOUR
CFM	CUBIC FEET PER MINUTE	MD	MANUAL DAMPER
CHP	CHILLED WATER PUMP	MOD	MOTOR OPERATED DAMPER
CHR	CHILLED WATER RETURN	MU	MAKE-UP WATER
CHS	CHILLED WATER SUPPLY	OA	OUTSIDE AIR
C.T.E.	CONNECT TO EXISTING	PD	PRESSURE DROP
CWP	CONDENSER WATER PUMP	PRV	PRESSURE REDUCING VALVE
D	CONDENSATE DRAIN	RA	RETURN AIR
DB	DRY BULB TEMPERATURE (°F)	RH	ROOF HOOD
EAT	ENTERING AIR TEMPERATURE (°F)	SB	SECURITY BARS
EF	EXHAUST FAN	SMD	SMOKE DAMPER
ESP	EXTERNAL STATIC PRESSURE	SPS	DUCT MOUNTED STATIC PRESSURE SENSOR
FD	FIRE DAMPER	SPD	SPLITTER DAMPER
HP	HEAT PUMP	VFD	VARIABLE FREQUENCY DRIVE
HWC	HOT WATER COIL	WB	WET BULB TEMPERATURE (°F)
HWP	HOT WATER PUMP	WL	WALL LOUVER
HWR	HOT WATER RETURN	W.O.	WALL OPENING
HWS	HOT WATER SUPPLY		

NOTE: THESE ARE STANDARD ABBREVIATIONS, ALL ABBREVIATIONS SHOWN ABOVE MAY NOT APPEAR ON DRAWINGS.

MECHANICAL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CEILING	T	THERMOSTAT OR TEMERATURE SENSOR
	DUCT	H	HUMIDISTAT OR HUMIDITY SENSOR
	EXISTING	S	WALL MOUNTED SWITCH
	PIPING		FLEXIBLE DUCTWORK
EQ #	EQUIPMENT DESIGNATION		MANUAL DAMPER
			FIRE DAMPER
A B C	AIR DISTRIBUTION TAG A. TYPE B. SIZE C. CFM		DUCT WITH LINER
			DUCT TRANSITION
#x#	DUCT SIZE – RECTANGULAR (INCHES)		SQUARE TO ROUND DUCT TRANSITION
#"ø	DUCT SIZE – ROUND (INCHES)	SPS	DUCT MOUNTED STATIC PRESSURE SENSOR
	DIFFUSER	SD	DUCT MOUNTED SMOKE DETECTOR
			WALL OPENING
	REUTRN AIR DISTRIBUTION DEVICE		SECURITY BARS
			WALL LOUVER
	EXHAUST AIR DISTRIBUTION DEVICE	S	SMOKE DAMPER
	DUCTWORK (POSITIVE PRESSURE)	M	MOTOR OPERATED DAMPER
			SPLITTER DAMPER
	DUCTWORK (NEGATIVE PRESSURE)		SUPPLY AIR ARROW
			RETURN AIR ARROW
	CONNECT TO EXISTING		
	DUCTWORK – EXISTING TO REMAIN		REMOVE EXISTING DUCTWORK

NOTE: THIS IS A STANDARD LEGEND. ALL ITEMS SHOWN MAY NOT APPEAR ON DRAWINGS.

SPECIFICATIONS

1. REFER TO OTHER DRAWINGS AND SPECIFICATIONS. CONTRACTOR SHALL BE RESPONSIBLE FOR APPLICABLE PROVISIONS THEREIN.
2. FURNISH AND INSTALL NECESSARY LABOR AND MATERIALS FOR A COMPLETE SYSTEM. ANY APPLIANCES OR MATERIALS OBVIOUSLY A PART OF THE SYSTEM AND NECESSARY FOR ITS PROPER OPERATION, ALTHOUGH NOT SPECIFICALLY MENTIONED HEREIN, SHALL BE FURNISHED AND INSTALLED AS IF CALLED FOR IN DETAIL.
3. WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE FOLLOWING STATE AND LOCAL CODES:
   THE INTERNATIONAL BUILDING CODE, 2006 EDITION WITH GEORGIA AMENDMENTS
   THE INTERNATIONAL MECHANICAL CODE, 2006 EDITION WITH GEORGIA AMENDMENTS
   THE INTERNATIONAL ENERGY CONSERVATION CODE, 2009 EDITION WITH GEORGIA AMENDMENTS
4. OBTAIN AND PAY FOR REQUIRED PERMITS AND FEES.
5. DRAWINGS ARE GENERALLY DIAGRAMMATIC AND DO NOT NECESSARILY SHOW EVERY FITTING AND DETAIL. INSTALL DUCTS, EQUIPMENT AND CONTROLS IN A NEAT WORKMANLIKE MANNER, AND IN ACCORDANCE WITH GOOD PRACTICE FOR A COMPLETE WORKABLE INSTALLATION. AVOID CONFLICT WITH OTHER WORK; MAKE ADEQUATE PROVISIONS FOR PREVENTING NOISE AND VIBRATION. ARRANGE EQUIPMENT INTO THE AVAILABLE SPACE IN A MANNER TO MAKE WORKING PARTS ACCESSIBLE FOR MAINTENANCE AND SERVICE.
6. MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED AGAINST DEFECTS FOR ONE YEAR. PROVIDE ADDITIONAL FOUR-YEAR WARRANTY ON COMPRESSORS.
7. PROTECT MATERIALS AND EQUIPMENT FROM DAMAGE DURING CONSTRUCTION.
8. EQUIPMENT AND MATERIALS SHALL BE NEW, UNLESS OTHERWISE SPECIFIED.
9. CONSTRUCT AIR DUCTS IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS, LATEST EDITION. DUCTWORK MATERIALS SHALL BE GALVANIZED SHEET METAL.
10. ELECTRICAL – DISCONNECTS AND/OR BREAKERS, POWER WIRING THRU MOTOR CONTROL DEVICES TO MOTORS OR TO JUNCTION BOXES OF FACTORY WIRED EQUIPMENT ARE PROVIDED UNDER THE ELECTRICAL DIVISION OF WORK. MECHANICAL WORK SHALL INCLUDE CONTROL AND INTERLOCK WIRING REQUIRED FOR PROPER OPERATION OF THE SYSTEM, AND SHALL INCLUDE FURNISHING OF MAGNETIC STARTERS OR CONTACTORS WHERE REQUIRED.
11. COORDINATE VOLTAGE AND PHASE OF EACH PIECE OF EQUIPMENT WITH ELECTRICAL CONTRACTOR BEFORE ORDERING.
12. LOCATIONS SHOWN FOR EQUIPMENT ARE APPROXIMATE LOCATIONS. CONTRACTOR SHALL COORDINATE WITH THE FIELD CONDITIONS FOR THE EXACT LOCATION AND CONFIGURATION, AND MODIFY DUCT SYSTEM ACCORDINGLY.
13. CONTRACTOR SHALL FIELD VERIFY AVAILABLE SPACE FOR DUCTWORK BEFORE FABRICATING. CONTRACTOR SHALL MODIFY DUCTWORK TO FIT AVAILABLE FIELD CONDITIONS. CUTTING OR OTHERWISE ALTERING ANY STRUCTURAL MEMBERS SHALL NOT BE PERMITTED WITHOUT WRITTEN PERMISSION FROM THE ARCHITECT.
14. PRIOR TO INSTALLATION AND ORDERING, SUBMIT FOR REVIEW FIVE COPIES OF SHOP DRAWINGS ON EQUIPMENT, AIR DISTRIBUTION DEVICES, AND CONTROLS.
15. INTERRUPTION OF SERVICE: THE DRAWINGS ARE BELIEVED TO BE A FAIRLY ACCURATE REPRESENTATION OF THE EXISTING WORK. HOWEVER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING ON SITE INVESTIGATIONS TO DETERMINE THE ACCURACY OF THE EXISTING CONDITION DRAWINGS. NO ATTEMPT HAS BEEN MADE TO SHOW ON THE DRAWINGS MECHANICAL WORK WHICH IS NOT CONSIDERED TO BE RELEVANT TO THIS PROJECT. IN PERFORMANCE OF THE WORK, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY EXISTING CONDITIONS AND THE EFFECT THAT THE WORK SHOWN ON THE DRAWINGS WILL HAVE ON THE EXISTING SERVICES. SHOULD THE ACTUAL CONDITIONS BE DIFFERENT FROM THOSE SHOWN ON THE DRAWINGS, THE CONTRACTOR SHALL NOTIFY THE OWNER FOR FURTHER INSTRUCTIONS PRIOR TO THE DISRUPTION OF THE EXISTING SERVICES.
16. EQUIPMENT SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

GENERAL NOTES

1. COORDINATE WORK WITH OTHER TRADES PRIOR TO INSTALLATION.
2. DUCT SIZES SHOWN ARE INSIDE CLEAR DIMENSIONS.
3. FOR NEW UNITS IN THIS SCOPE OF WORK, PROVIDE A 7-DAY PROGRAMMABLE, AUTOMATIC CHANGEOVER THERMOSTAT WITH 50 FEET OF ADDITIONAL CONTROL WIRING IN THE SPACE. COIL WIRING AND LOCATE WITH THERMOSTAT AT INTERIOR UNITS, OR ON WALL ADJACENT TO EXTERIOR UNITS.
4. REFRIGERANT PIPING SHALL BE SIZED BASED ON MANUFACTURERS REQUIREMENTS, COORDINATED WITH LINESET LENGTHS, AND INSULATED WITH 1" THICK FLEXIBLE CELLULAR PIPE INSULATION.
5. REMOVE EXISTING CEILING TO THE EXTENT REQUIRED FOR THE NEW WORK SHOWN ON THE DRAWINGS. REMOVE EXISTING CEILING BELOW NEW MECHANICAL EQUIPMENT

SPLIT SYSTEM HEAT PUMPS

MARK	AIR UNIT					COOLING CYCLE		HEATING CYCLE		HEAT PUMP
	CFM	O.A. CFM	ESP (IN W.C.)	SUPPLEMENTAL HEAT CAPACITY (MIN. KW)	VOLT/ PHASE	NOMINAL CAPACITY (TONS)	MIN. SEER	NOMINAL CAPACITY (MBH@47°F)	MIN. COP	ELEC. CONNECTION VOLT/ PHASE
AU-1 / HP-1	1900	35	0.75	18	208 / 3	5.0	13	56.0	3.8	208 / 1
AU-2 / HP-2	800	35	0.75	7.2	208 / 3	2.0	13	24.0	3.8	208 / 1

NOTES:
AIR UNITS SHALL BE JOHNSON CONTROLS AVY, OR EQUAL BY TRANE OR CARRIER.
HEAT PUMPS SHALL BE JOHNSON CONTROLS YZB, OR EQUAL BY TRANE OR CARRIER.

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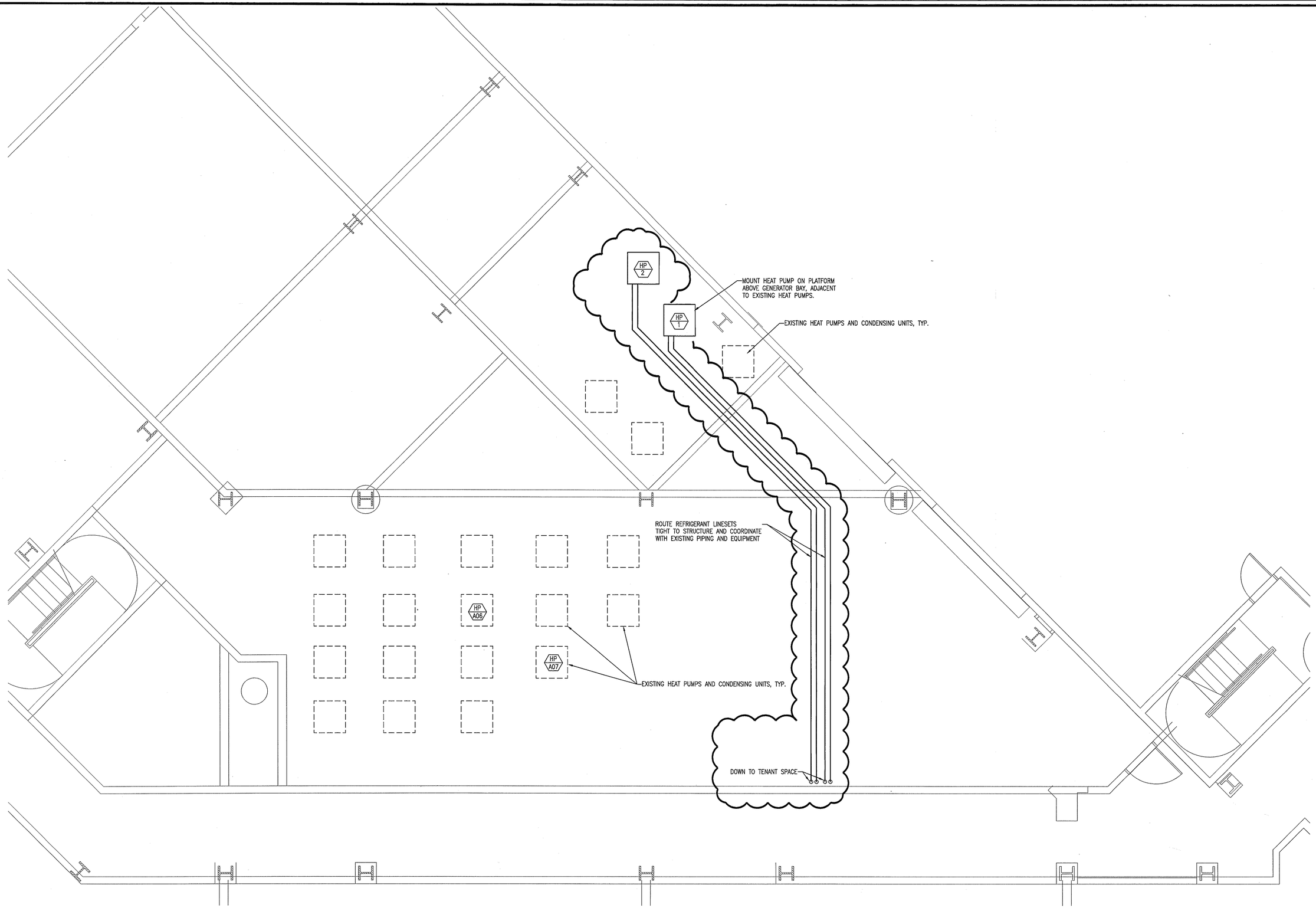
SUITE A06/A07 LANDLORD WORK
WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

GEORGIA REGISTERED NO. 25559 PROFESSIONAL ENGINEER PATRICK C. MILLER

DOCUMENT ISSUE RECORD

NO	DATE	DESCRIPTION
1	9-12-13	FOR CONSTRUCTION
2	9-18-13	REVISIONS
3	11-08-13	REVISIONS

PROJECT NO.
13-072
SCALE
AS SHOWN
SHEET TITLE
MECHANICAL SPECIFICATIONS
SHEET NO
M0.1



1 SECOND FLOOR PLAN - MECHANICAL
Scale: 1/4" = 1'-0"

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SUITE A06/A07 LANDLORD WORK

WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
ATLANTA, GA

GEORGIA REGISTERED No. 25559 PROFESSIONAL ENGINEER PATRICK C. WILKES

DOCUMENT ISSUE RECORD

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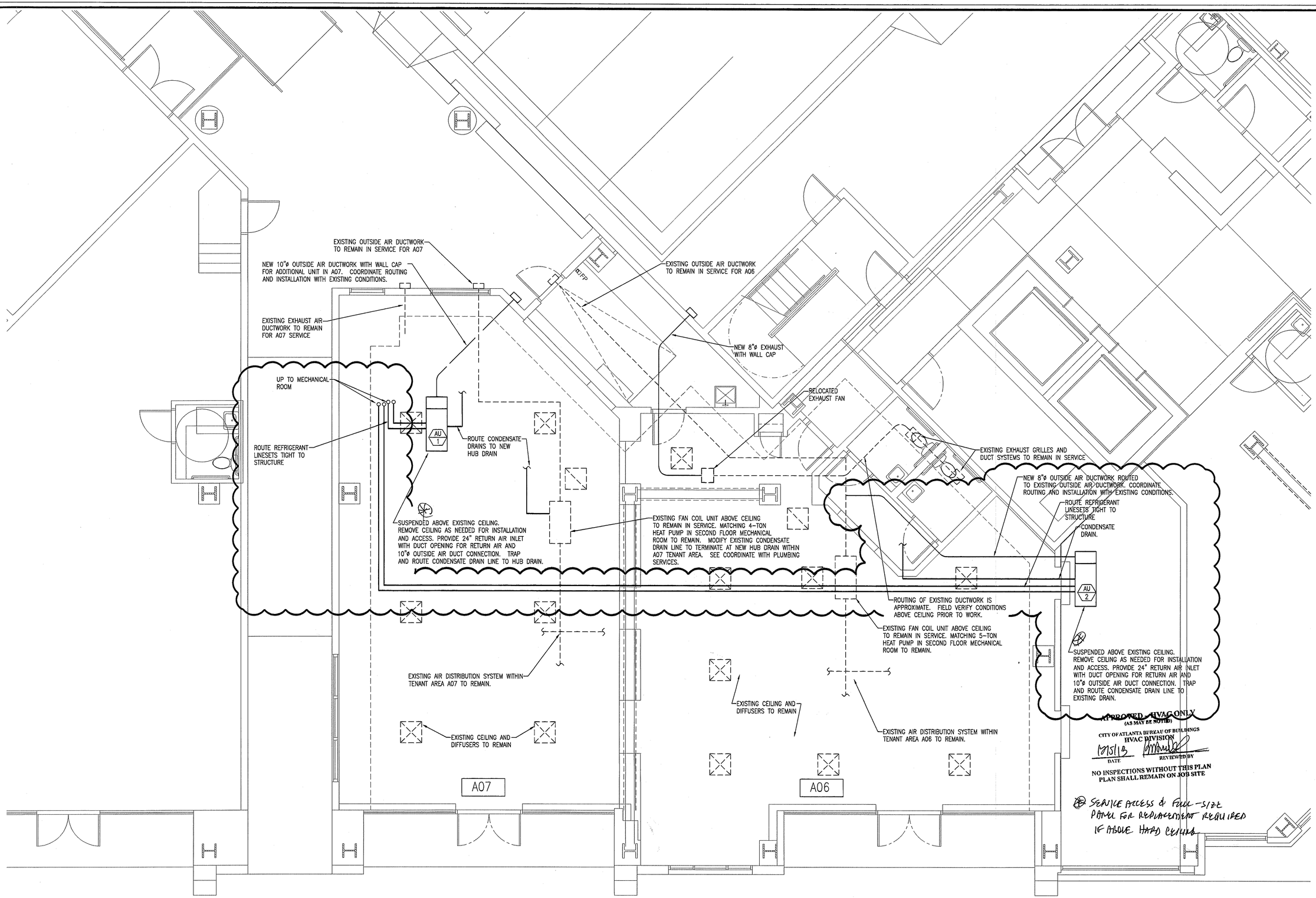
PROJECT NO.
13-072

SCALE
AS SHOWN

SHEET TITLE
MECHANICAL
NEW WORK PLAN
SECOND FLOOR

SHEET NO
M2.1



1 FIRST FLOOR PLAN - MECHANICAL
Scale: 1/4" = 1'-0"

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SUITE A06/A07 LANDLORD WORK

WHITE PROVISIONS BUILDING A
1100 HOWELL MILL ROAD
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13-072

SCALE
AS SHOWN

SHEET TITLE
MECHANICAL
NEW WORK PLAN
FIRST FLOOR

SHEET NO
M2.0